3 10 00048

5246

Document No. PG-361-700

Remedial Investigation Report for the Cold Creek/LeMoyne Site Mobile County, Alabama

Draft (Revision # 2)

Prepared for:

Akzo Chemie America
Chicago, IL

ICI Americas
Wilmington, DE

January 1988

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF APPENDICES

APPENDICES (Continued)

APPENDIX XXIII - GROUND-WATER INTERCEPT AND TREATMENT PROGRAM

APPENDIX XXIV - SUMMARY TABLE OF MONTHLY THIOCARBAMATE DISCHARGE ANALYSIS, TABLE 24-1

APPENDIX XXV - EXPLANATION OF WHY THE MERCURY LOCATED IN THE COLD CREEK SWAMP IS IN THE INORGANIC MERCURY SULFIDE FORM

APPENDIX XXVI - PLANT FACILITIES INFORMATION AND DRAWINGS

APPENDIX XXVII - GRAPHIC AND DESCRIPTIVE WELL LOGS

APPENDIX XXVIII - WATER-LEVEL DATA

APPENDIX XXIX - ECKHARDT SURVEY INFORMATION REGARDING THE LEMOYNE LANDFILL

3 10 00053

LIST OF FIGURES

LIST OF FIGURES (Continued)

3 10 00055

LIST OF TABLES

LIST OF TABLES (Continued)

PRODUCTS WITH REGISTERED TRADENAMES

Throughout this report, a number of chemical product names appear. The following list indicates those products which have registered tradenames:

Betasan
Imidan
Dyfonate
Crystex
Trithion
Eptam
Sutan
Vernam
Tillam
Ordram
Ro-neet

EXECUTIVE SUMMARY

Site Background

Stauffer Chemical Company previously owned and operated a multi-product inorganic chemical manufacturing plant at LeMoyne, Alabama and an agricultural chemical facility at the adjacent Cold Creek site. The LeMoyne plant, purchased by Akzo Chemie America, Inc. in 1987, has been in operation since 1953. The Cold Creek plant has been in operation since 1966 and is currently owned by ICI Americas, Inc. Halby Chemical Company (later part of Witco, Inc.) also operated a small facility for a time on a leased section of the LeMoyne property.

Until 1973, industrial wastes from these operations were disposed in unlined disposal areas and, in the case of wastewater, to unlined ponds or, after treatment, by discharge to Cold Creek Swamp. Presumably as a result of these practices, a ground-water contamination problem developed. This was recognized in the early 1970's, and many improvements and waste-handling modifications were made. Lined ponds were installed, solid wastes were diverted for off-site treatment and/or disposal, and the existing disposal sites were cleaned, consolidated, and capped with impermeable liners and clay. The ground-water problem was addressed by installation of an intercept and treatment system. This latter work was conducted with the review of, and approval by, the Alabama Water Improvement Commission (AWIC), predecessor agency to the present Alabama Department of Environmental Management (ADEM).

In 1982, an assessment of the plant sites was made by the Alabama Department of Public Health in response to submissions made by Stauffer to the House Committee on Interstate Commerce ("the Eckhardt Survey"). At the request of the Alabama Department of Public Health, monitoring wells were installed around the three closed landfills. In spite of the previously identified ground-water problems already under remediation, data primarily from these monitoring wells were held by the Federal Environmental Protection Agency (EPA) to be the basis for inclusion of these facilities on the National Priorities List (NPL), which ranks hazardous waste disposal sites under provisions of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), commonly known as "Superfund".

Purpose of Investigation

Camp Dresser and McKee, Inc. (CDM), under contract to the EPA, conducted preliminary sampling at the site in May of 1985 and prepared a Work Plan which is the basis for this Remedial Investigation (RI). Based on the sampling and previous investigations of both the Cold Creek and LeMoyne sites, and offsite on Courtaulds North America's (CNA) property, CDM concluded that there was possible ground-water contamination (primarily mercury, carbon tetrachloride, carbon disulfide and thiocarbamates). Further, CDM suggested that some contaminants were moving offsite towards the CNA production wells. The major potential sources of contamination were considered to be the Cold Creek Swamp, unlined waste holding and treatment ponds, and the Cold Creek and LeMoyne landfills (see Figure ES-1).

For the purpose of the RI, the Cold Creek and LeMoyne properties are considered one site, as outlined in the Work Plan and agreed upon by the EPA. The purpose of this Remedial Investigation is to characterize the type and extent of contamination; to identify contamination sources, migration pathways, and the potential for adverse environmental impacts; and to provide a basis for evaluation of the most cost-effective remedial action alternatives.

The Cold Creek/LeMoyne site is located just off U.S. Highway 43, approximately 20 miles north of Mobile, Alabama (see Figure 1-1 in Section 1.2). The site is surrounded by several other chemical production plants, and the site area is very sparsely populated, the nearest community being Creola, 5 miles to the south. The Cold Creek Swamp lies between the plant sites and the Mobile River, which is approximately 1 1/2 miles to the east of the main facilities. The swamp flows northeast, then east, discharging to the Mobile River.

The Cold Creek plant manufactures proprietary herbicides and pesticides used in agricultural farming. Among the principal products made are Betasan, Imidan, Dyfonate and several thiocarbamates. The LeMoyne plant manufactures carbon disulfide, carbon tetrachloride, sulfuric acid, caustic, chlorine and Crystex (a proprietary sulfur compound).

Previous Remedial Activities

As mentioned above, after ground-water contamination was discovered in the early 1970's, investigations of potential sources were initiated and clean-up activities begun. Two unlined waste burial sites at Cold Creek were capped as was the LeMoyne landfill. The use of unlined wastewater treatment ponds was discontinued, and several were closed. New lined ponds were installed, and the treated wastewater was discharged to the Mobile River. Spill control and storm-water recycling and drainage controls were put in place. Low-lying plant areas adjacent to the unnamed stream feeding the Cold Creek Swamp were selectively backfilled with clean fill material to control flooding. A number of monitoring wells were drilled and ground-water analysis commenced.

Finally, after a hydrogeologic investigation by Ground Water Associates, Inc. (GWA), Stauffer, in 1980, installed a ground-water intercept and treatment system. This system, which has been operating since 1981, consists of three interceptor wells with a total design capacity of 1500 gallons per minute (gpm). The wells are situated along the southern property line and are located just downgradient of the inactive carbon tetrachloride (CTC) plant wastewater treatment (WWT) pond. Contaminated ground water is pumped to an air stripping/aeration pond and, following treatment, is discharged to the Mobile River under provisions of an NPDES permit (see Appendix XXIII for a more detailed description of the ground-water intercept and treatment program). Since this installation, the ground water has steadily improved in quality.

The RI field investigation, as proposed in CDM's Work Plan, was carried out in total except for the conditional Phase II swamp sampling. Based on the initial swamp soil sampling and the ground-water sampling results, EPA decided to omit the Phase II sampling. A total of 311 samples were collected between May and August of 1986. Complete analytical results are included in Appendices I-1 through V-2, and summary tables are presented in Chapters 1 and 5.

Major Investigation Findings

The Cold Creek Swamp was sampled at 34 locations with 3-foot deep soil borings (see Drawing Number 1.3 in Appendix XVII for locations). The same technique was used at four locations in the LeMoyne Swamp (see Figure 5-3). Seven composite soil samples were analyzed for thiocarbamates, chlorides and priority pollutants (Tables 5-7 and 5-8), and 31 samples for mercury only (Table 5-9). Except for mercury, no priority pollutants were found other than typical levels of some heavy metals commonly found in natural soils (see Appendix XVIII for comparison). Most thiocarbamates were found to be non detectable, with a few between 0.1 and 1.8 milligrams per kilogram (mg/kg, or parts per million, ppm). Mercury concentrations, as shown in Table 5-9 and Drawing 1.3 (Appendix XVII), indicated low to high (BMDL to 690 mg/kg) levels. No mercury was found in any of the ground-water samples indicating, as shown later, that mercury was not being transmitted from the swamp to adjacent underlying ground waters.

Fish samples were collected at five locations and analyzed for mercury. Levels ranged from 0.4 to 3.1 mg/kg whole fish. The species of fish collected are shown in Appendix XXI.

A total of twelve soil samples were taken around the three landfills (see Figure 5-1 and Tables 5-1, 5-2 and 5-3). No priority pollutants were found other than low parts per million (ppm) levels of a few heavy metals. A few samples showed above average values for antimony and mercury. The area around and under the Cold Creek landfills showed no detectable levels of site-specific (production-related) compounds with minor exceptions, the highest being 1.5 mg/kg molinate. Vanadium levels were typically 1.1 to 30 mg/kg, which are low compared to those found in natural soil (20 to 500 mg/kg; see Appendix XVIII). The synthetic membrane covering of each of the landfills was exposed and sampled. These were found to be sound with no apparent deterioration (see Appendix XVI).

Eighteen (18) soil borings were made around nine ponds (see Figure 5-2, Tables 5-4 and 5-5). Analysis of composite samples did not detect priority pollutants except for background levels of some heavy metals. A sample taken inside the closed Halby pond showed high levels of copper (442 mg/kg), zinc (1,170 mg/kg) and cyanide (240 mg/kg), but samples taken adjacent to the pond were at or below background levels for these compounds. Heavy metals were not found in the ground water. Site-specific compounds were not detected in soil samples with the exception of thiocyanate found in soil in and around the Halby pond and low levels of thiocarbamates under Cold Creek's closed neutralization pond. Priority pollutants were not detected in surface-water samples from two small unnamed tributaries to Cold Creek or in samples taken from three active ponds.

Ground-water samples were collected from 15 source wells and 36 area wells (see Figures 4-2 and 4-3 and Tables 5-11 and 5-12). Except for expected high levels of carbon disulfide (CS_2) and carbon tetrachloride (CTC) in wells 0-29 and 0-31, which are located just downgradient of the old CTC plant wastewater treatment pond (see Figure 5-6), all other samples showed essentially no detectable levels of priority pollutants. Three other wells in the immediate vicinity of the old carbon tetrachloride plant WWT pond showed low levels (0.8 to 1.5 milligrams per liter, mg/l, which is equivalent to ppm) of CTC. All well samples analyzed for site-specific compounds showed non-detectable to very low levels, except for 6 mg/l thiocyanate in well 0-79, which is just downgradient of the Halby pond.

Conclusions

These ground-water results demonstrate conclusively that the mercury found in the swamp soil is insoluble and not leaching to the aquifer. Further, a review of well water results shown in Figures 5-6 and 5-7 shows clearly that the ground-water intercept system has been very effective in capturing CTC and CS_2.

The following major points can be made:

- Except for carbon tetrachloride found in source wells immediately downgradient of the old carbon tetrachloride plant WWT pond, essentially no priority pollutants were found in any ground-water samples.
- Although mercury was found in swamp soil samples, it is in an insoluble form as evidenced by its absence in ground water (see Appendix XXV).
- With two minor exceptions, all source wells sampled indicate thiocarbamates to be at very low levels (less than 0.06 milligrams per liter and most under 0.01 mg/l).
- All area wells south (immediately downgradient) of the property line contained less than 0.027 mg/l thiocarbamates, less than 0.046 mg/l CS_2, and less than 0.018 mg/l CTC. The one exception was NM-1, just downgradient of the LeMoyne landfill (one mile east of main facility), which contained 0.25 mg/l of CTC.

2. SITE FEATURES

2.1 Demography

As mentioned previously, the Cold Creek/LeMoyne site is situated just to the east of U.S. Highway 43 and approximately 20 miles north of Mobile, Alabama. Interstate Highway 65 is located 7 miles south of the site. The LeMoyne plant property, which is south of the Cold Creek plant, extends eastward to the Mobile River. The manufacturing facilities, however, are one and one-half miles from the river.

The Cold Creek/LeMoyne complex, which encompasses approximately 947 acres, is in an industrial area comprised mainly of other chemical production plants. Courtaulds North America, Inc. (CNA), which manufactures viscose rayon fiber, is located directly south and borders the LeMoyne plant. Shell Chemical Company (now duPont), an insecticide manufacturer, is south of CNA. Virginia Chemicals, Inc. is north of the Cold Creek plant, and M&T Chemicals is northwest. Alabama Power operates a coal-fired electrical generating station further north.

Very sparsely populated, rural communities are within a few miles of the site. The largest residential areas are Mt. Vernon, located approximately 8 miles to the north, and Creola, which is approximately 5 miles to the south (see Appendix VIII for map showing locations of nearby residences).

2.2 Land Use

The land in the immediate vicinity of the Cold Creek/LeMoyne complex is used almost entirely by industrial plants. In addition, some forest products are also harvested in the area. Because of the natural swamp, no farming is done in the area.

2.3 Natural Resources

The major natural resource in the site area is the Mobile River, which is located one and one-half miles to the east of the main plant facilities. At its closest point to the site, the river is approximately 500 feet wide and has a mean depth of 28 feet. Minimum flow, which is exceeded 99% of the time, is 4,800 cubic feet per second representing 3.1 billion gallons per day. Further information regarding the Mobile River can be found in the publication entitled "Water Resources of the Mobile Area, Alabama," which is included in Appendix XIV. The river, which flows south discharging into the Gulf of Mexico, is mainly used for barge transportation.

Some oil wells have been drilled 5 to 10 miles south of the site, but no oil has been discovered within the site area. Some cypress trees and pulpwood are harvested on the east side of the Mobile River.

2.4 Climatology

The climate in the site area is temperate, bordering on subtropical. The mean annual temperature is 67.6 degrees Farenheit. July is the hottest month, and January is the coldest month. Winters are usually short and mild with only a few days with temperatures below freezing. The summers are usually hot and humid. Average annual rainfall is 63.6 inches and is evenly distributed throughout the year. Average monthly temperature and rainfall data are presented in Table 2-1 (Hickman and Owens, 1978). Heavy rainfalls are common in the area, and a summary of data on rainfall intensity is given in Appendix IX (Stauffer interoffice correspondence, Bill Erdmann to Bill Cawthra dated 9/26/78).

3 10 00066

TABLE 2-1

TEMPERATURE AND RAINFALL DATA

(recorded 1951-1975 at Mobile, Alabama)

Month	Average Temperature (^{O}F)	Average Rainfall (in.)
January	51.6	4.39
February	54.0	5.13
March	59.9	6.12
April	67.9	5.18
May	75.0	4.63
June	80.4	5.34
July	82.1	7.80
August	81.7	6.89
September	77.9	6.52
October	68.9	2.51
November	58.7	3.30
December	53.4	5.77
YEARLY	67.6	63.58

1. INTRODUCTION

1.1 Objectives

Two adjacent sites in Mobile County, Alabama, formerly owned by Stauffer Chemical Company, were placed on the National Priorities List (NPL) by the Environmental Protection Agency (EPA) in 1982 under provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). As a result, Camp Dresser and McKee, Inc. (CDM), under contract to the EPA, conducted preliminary sampling at the site in May of 1985 and prepared a Work Plan, which is the basis for this Remedial Investigation (RI).

Based on the sampling results and previous investigations both onsite and offsite, CDM concluded that there was possible ground-water contamination, primarily mercury, carbon tetrachloride, carbon disulfide, and thiocarbamates, at the site. Furthermore, CDM suggested that some contaminants were moving offsite towards production wells at a facility south of the site. Possible major sources of contamination were identified. The purpose of this Remedial Investigation is to characterize the type and extent of contamination; to identify contamination sources, migration pathways and the potential for adverse environmental impacts; and to provide a basis for evaluation of the most cost-effective remedial action alternatives.

1.2 Site Background Information

1.2.1 Site Location and Description

Stauffer Chemical Company previously owned and operated two adjacent facilities in Mobile County, Alabama. The LeMoyne plant, purchased by Akzo Chemie America, Inc. in 1987, has been in operation since 1953 and manufactures multi-product inorganic chemicals, including carbon disulfide, carbon tetrachloride, sulfuric acid, chlorine and Crystex (a proprietary sulfur compound). The Cold Creek plant manufactures agricultural herbicides and pesticides, including several thiocarbamates. The Cold Creek plant has been in operation since 1966 and is currently owned by ICI Americas, Inc. (ICIA).

In the past, the Halby Chemical Company (HCC) leased a small parcel of land on the western portion of the site. Little is known of this operation, however, other than that waste products and effluents from the facility were held in a pond on the property. The pond has been closed and filled.

The Cold Creek/LeMoyne site ("the site") occupies 947 acres between the Mobile River and U.S. Highway 43, approximately 20 miles north of Mobile, Alabama (see Figure 1-1). The site is bounded by Virginia Chemicals, Inc. (VCI) to the north, Courtaulds North America (CNA), another chemical company, to the south, the Mobile River to the east, and Route 43 to the west. M&T Chemicals is located immediately to the west of Route 43. VCI produces sulfur dioxide, amines, sodium hydrosulfite, sodium bisulfite, and tetramethylfuran disulfide. CNA consists of a viscose rayon fiber processing plant and nylon spinning operation. M&T Chemicals is an organotin compound manufacturing plant.

The site is situated in a predominantly industrial area, but several sparsely populated rural communities are located within a few miles of the site. Maximum relief at the site is on the order of 30 feet. The Cold Creek Swamp lies between the plant facilities at the site and the Mobile River, and flows to the northeast and then east to discharge into the river. Surface-water drainage on site is generally toward the swamp or the river, and is governed by a drainage divide between the two. The Mobile River flows to the south and discharges into the Gulf of Mexico.

The majority of the chemical plants as well as the local communities in the area obtain water supplied from the water-table aquifer. As shown in Figure 1-2, the Cold Creek facility has one drinking-water well (CC-12) and one backup well

3 10 00069

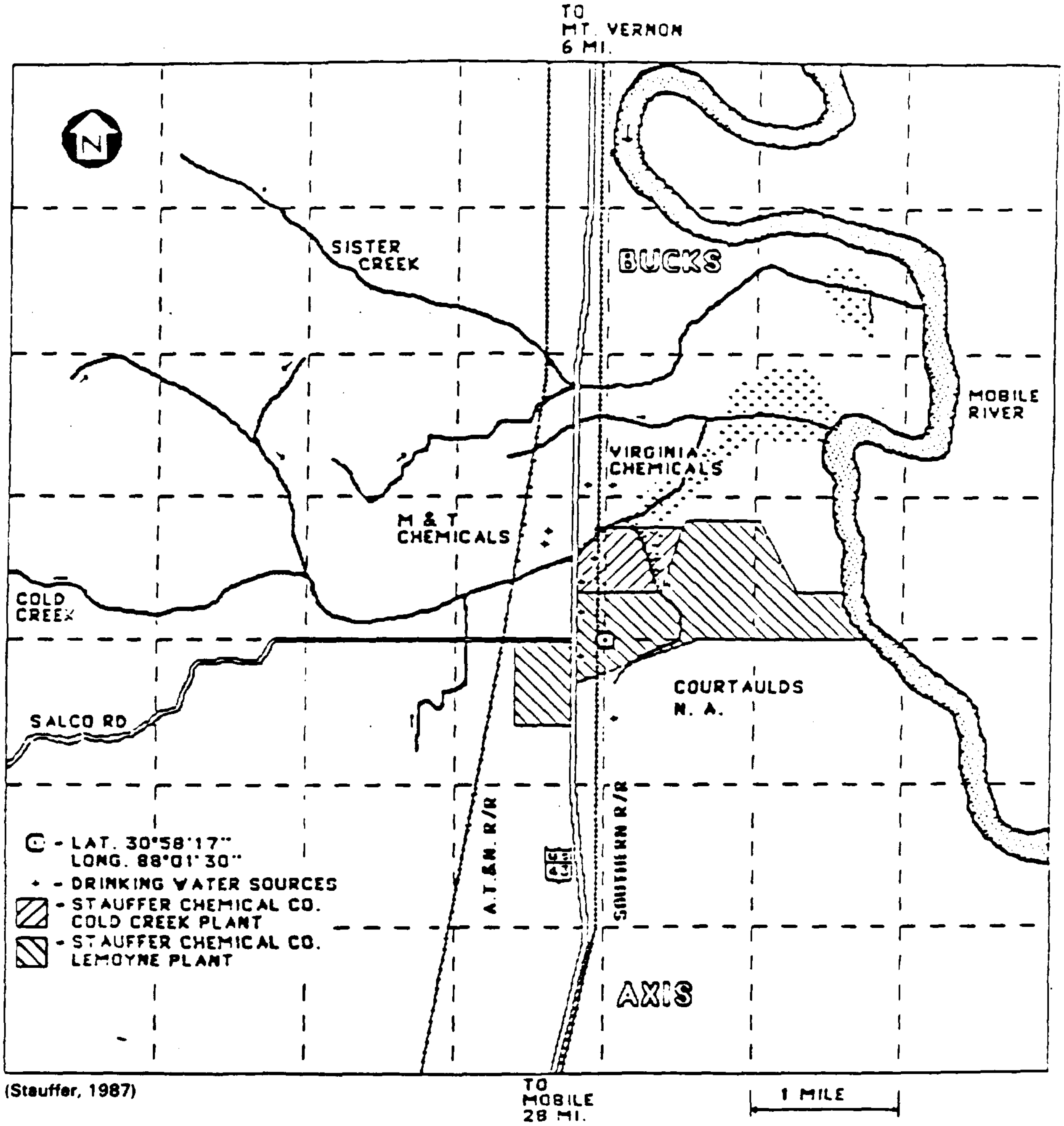


Figure 1-1 Approximate Location of the Cold Creek/LeMoyne Site Mobile County, Alabama

8801027

8801028

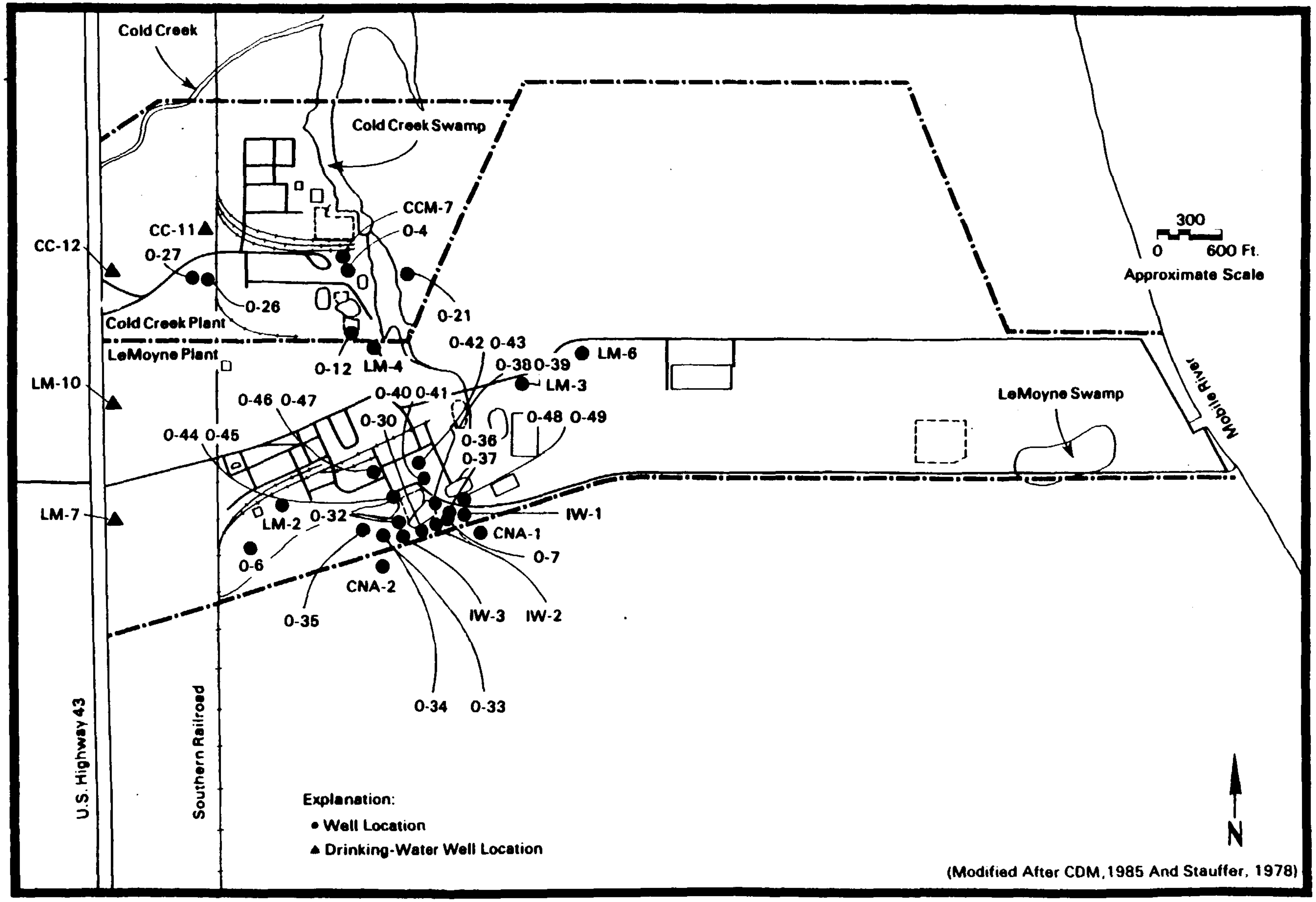


Figure 1-2 Site Area Well Locations

(CC-11), which serve 250 employees. The LeMoyne facility has two drinking-water wells (LM-7 and LM-10), which provide water for 230 employees. The CNA facility to the south has one drinking-water well (CNA-16) and a backup well (CNA-4), which provide drinking water to 750 employees. M&T Chemicals, located northwest of the site, also utilizes well water as a drinking-water source for its 200 employees. The total population served by industrial drinking-water supply wells within a two-mile radius of the site is 1,585 people.

As shown in Figure 1-3, a total of approximately 21 residential water wells are located within a two-mile radius of the site. Seventeen of these wells are located more than 1 1/2 miles west of the site. One well is located 2 miles due south of the site, and another is located 2 miles north of the site. The remaining 2 wells are located 1 mile southwest of the site. The total population served by residential drinking-water supply wells within a two-mile radius of the site, assuming 4 persons per home, is 84. The other residences located within two miles of the site are served by municipal water. The population within a two-mile radius of the site is not located downgradient to ground-water movement.

1.2.2 Site Use History

For approximately 20 years after initiation of operations at the Cold Creek/LeMoyne site, industrial waste products resulting from the Stauffer processes were disposed of in unlined surface disposal sites. From 1965 to 1974, solid waste from the LeMoyne plant was placed in an unlined landfill approximately one mile east of the plant. Between 11,000 and 12,000 tons of brine muds were placed in this landfill along with plant refuse, used samples, and some absorption oil (see Appendix XXIX for information contained in the Eckhardt Survey, which lists the substances stored in this landfill).

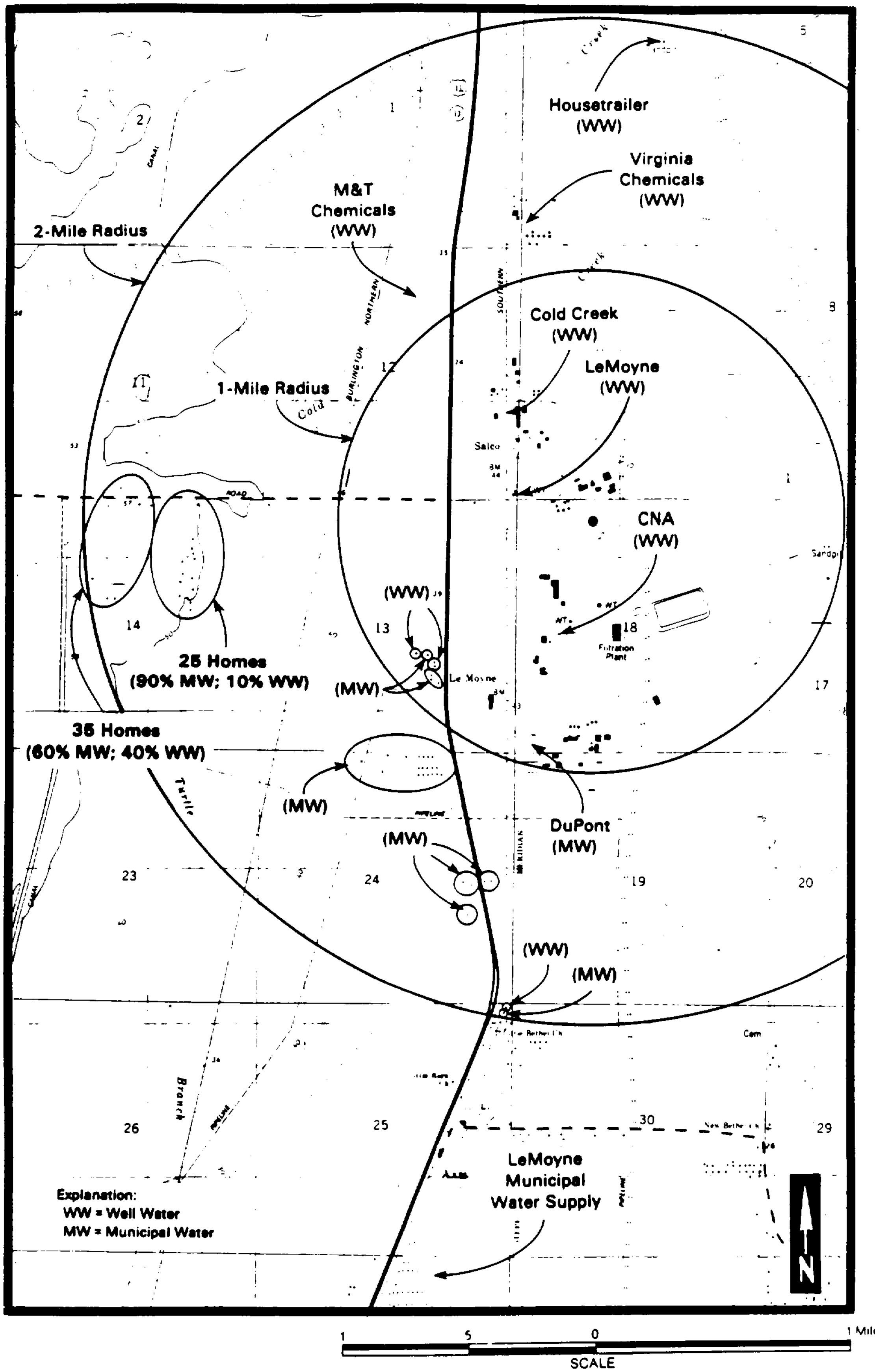


Figure 1-3 Location of Water Wells Within Two Miles of the Cold Creek/LeMoyne Site

8801029

Two waste disposal sites, referred to as the north and south landfills, are located on the Cold Creek plant property. The exact quantity of material placed in the landfills is not known; however, sludges and solid wastes containing a variety of herbicides and pesticides are thought to have been buried in these two landfills. The LeMoyne and the two Cold Creek landfills were closed and capped with liners in 1974.

Wastewaters from the Stauffer processes were held in clay-lined lagoons and discharged to the Cold Creek Swamp. As shown in Figure ES-1, there are currently six closed or inactive wastewater ponds and seven active ponds. The seven active ponds, LeMoyne LeCreek, Cold Creek LeCreek, the new carbon tetrachloride plant wastewater treatment (WWT) pond, the ground-water treatment pond, the LeMoyne acid plant WWT (solids settling) pond, and the north and south chlorine plant wastewater check ponds, are all membrane-lined and monitored regularly. Of the six inactive wastewater treatment ponds, four (old carbon disulfide plant WWT pond, old chlorine plant WWT pond, Halby treatment pond, and Cold Creek old neutralization pond) are closed and covered. The old carbon tetrachloride plant WWT pond was lined and contains approximately 1900 cubic yards of sulfur sludge; it is inactive but not closed. The old brine mud pond is a lined pond used for storage of brine muds from the chlorine plant. It was originally a RCRA facility but has been delisted by the EPA; closure is awaiting State approval. Two ponds on the site are RCRA facilities (new brine mud pond and chlorine stormwater surge pond) and meet current RCRA standards. Three fire water storage and supply ponds are also located on the site.

Cold Creek Swamp received effluent from the LeMoyne and Cold Creek plants as well as from a previous tenant, the Halby Chemical Company (HCC). The effluent from the LeMoyne plant consisted of process waters from production units, containing 10 parts per million (ppm) of mercury. Neutralized waste brine from the Cold Creek plant was also discharged to the swamp during the late 1960's and early 1970's. The contribution from

HCC was assumed to have been thiocyanate- contaminated wastewater. The LeMoyne Swamp may have received surface-water runoff from the area of the LeMoyne landfill prior to its closure in 1974.

A small parcel of land on the western portion of the Cold Creek/LeMoyne site was leased from 1965 to 1979 to the Halby Chemical Company (HCC), as noted above. Witco, Inc. purchased the HCC facility in 1974, and continued to operate the plant until approximately 1979, when the buildings were razed. Although little is known of this operation, waste products and effluents were reported to have been discharged to the Cold Creek Swamp to the east and/or held in a pond on the property. The Halby pond has since been closed and filled.

1.2.3 Previous Investigative and Remedial Activities at the Site

During the late 1960's, Stauffer monitored their on-site water-supply wells and CNA monitored their production wells for chloride content. By 1971, ground-water monitoring results indicated that chloride concentrations in the wells were increasing, and the ground-water quality was deteriorating.

In October, 1972, an inventory shortage of approximately 10,000 gallons of carbon tetrachloride (CTC) was discovered at the LeMoyne facility storage area. All of the CTC is assumed to have seeped into the ground. Although the CTC storage tank was not diked, a short retainer wall separated it from a nearby fire pond, which, therefore, was unlikely to have been affected by the release (see Appendix XXII for maps of the LeMoyne plant which show the location of the CTC storage area and the spill area). None of the CTC could be recovered.

By early 1973, Stauffer determined that contaminants were entering the ground water beneath the plant sites, and an in-house task force was organized to evaluate the problem and develop recommendations for remedial action. Twenty-one ground-water monitoring wells were installed, and a swamp-sediment sampling program was initiated. The major contaminants found in the ground water were thiocarbamates, chlorides, and sulfur compounds. Mercury, most likely in the insoluble mercury sulfide form (See Appendix XXV), was found in the swamp sediment samples but not in the ground water. The major sources of these contaminants were determined to be Cold Creek Swamp, unlined wastewater holding and treatment ponds, unlined waste-disposal sites containing drummed and uncontained waste materials, process leaks and spills, and leachate from contaminated soils. The predominant areas of ground-water contamination were to the south and east of the site.

By late 1973, Stauffer had initiated contaminant source cleanup activities. Drummed waste debris and sludges in the disposal areas were consolidated and transported off site to permitted hazardous-waste landfills. Liquids were decanted and removed for treatment or off-site commercial disposal. The disposal areas were permanently closed and capped with an impermeable synthetic liner, clay, and soil. Ponds were dewatered, filled, and replaced with lined ponds. Pursuant to an NPDES permit, effluent flow from both facilities was treated and discharged to the Mobile River instead of the swamp. Low-lying areas were regraded with clean fill from construction activities in order to control local flooding, and a stormwater drainage control system was designed and constructed. These source control and cleanup activities were completed in 1976.

In addition to the remedial activities described above, an extensive ground-water monitoring program was initiated in December of 1973. Ground-water monitoring continued, and by late 1977, Stauffer concluded that ground-water quality along the southern property boundary of the LeMoyne facility was improving but at an unacceptable rate (see Appendix XX). In addition, CNA reported continued contamination of two of their wells, chloride and iron being the primary contaminants. In response to continuing ground-water quality deterioration, Stauffer installed seven new observation wells along the southern property line of the LeMoyne facility.

In December, 1977, leak detection systems for two treatment and storage ponds on site indicated leakage through pond liners. These two treatment and storage ponds were subsequently repaired. In 1978, Stauffer dewatered and capped an old mercury sulfide WWT pond and a WWT pond in the carbon disulfide plant area.

In 1978, Stauffer contracted with Ground Water Associates, Inc. (GWA) to perform a hydrogeological investigation of ground-water contamination at the LeMoyne facility. During September of that year, GWA collected water samples from 32 wells and analyzed the samples for carbon tetrachloride and carbon disulfide contamination. The results are shown in Figures 1-4 through 1-10, respectively. Based on the analytical results and the results of pump tests, it was concluded that three intercept wells, each pumping a maximum of 500 gallons per minute (gpm), would be required to intercept the bulk of the contaminated ground water. GWA used a numerical model to represent the aquifer system, including the proposed intercept wells. The resultant contour map of the regional piezometric surface is shown in Figure 1-11. GWA concluded that "this map indicates that it is not likely that any contamination from the Stauffer property will migrate further than CNA's wells Nos. 5, 6 and 10. Some contamination [present prior to installation of the intercept wells] will probably reach these wells, however, and samples of their water should be periodically analyzed for traces of carbon tetrachloride and carbon disulfide".

The three interceptor wells were installed in late 1980 along with an air stripping treatment system approved by the Alabama Water Improvement Commission (AWIC), which is now the Alabama Department of Environmental Management (ADEM). Since that time, the levels of ground-water contamination have been substantially reduced, as shown in Figure 1-12, and treated effluent concentrations have continuously met discharge permit limits established by the ADEM (see Appendices XXIII and XXIV).

8801030

3 10 0077

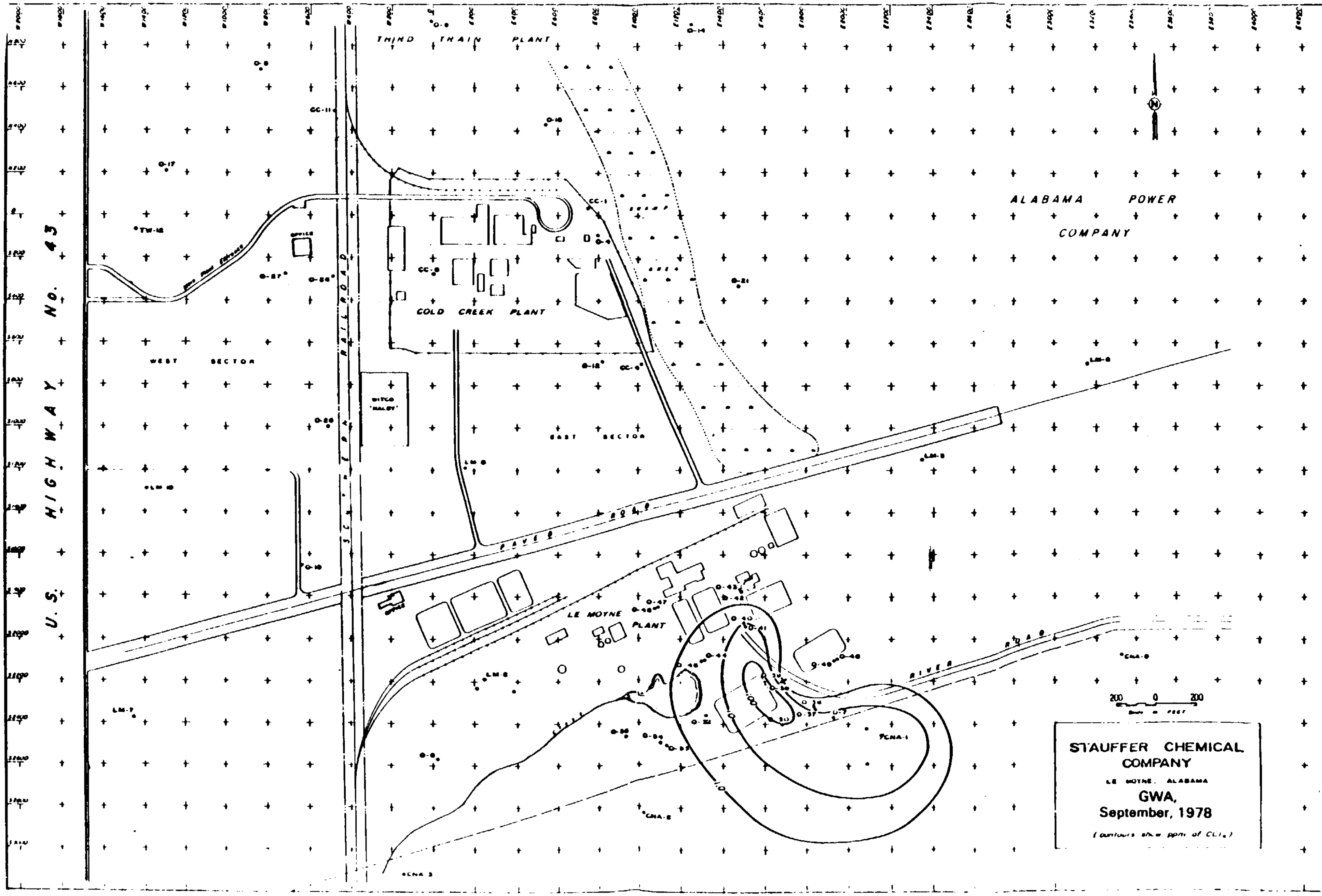


Figure 1-4 Concentration of Carbon Tetrachloride in Shallow Wells

8801031

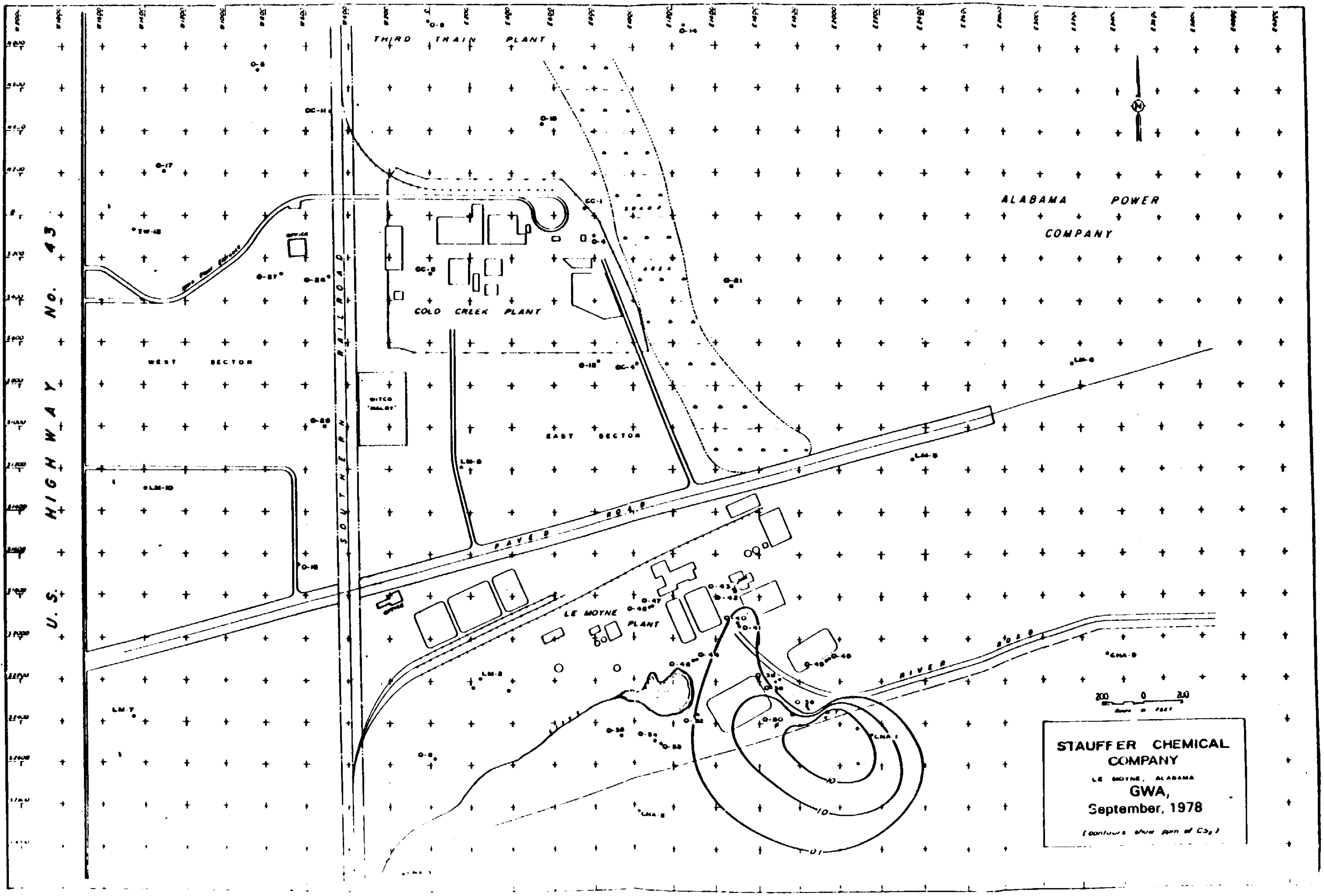


Figure 1-5 Concentration of Carbon Disulfide in Shallow Wells

8801032

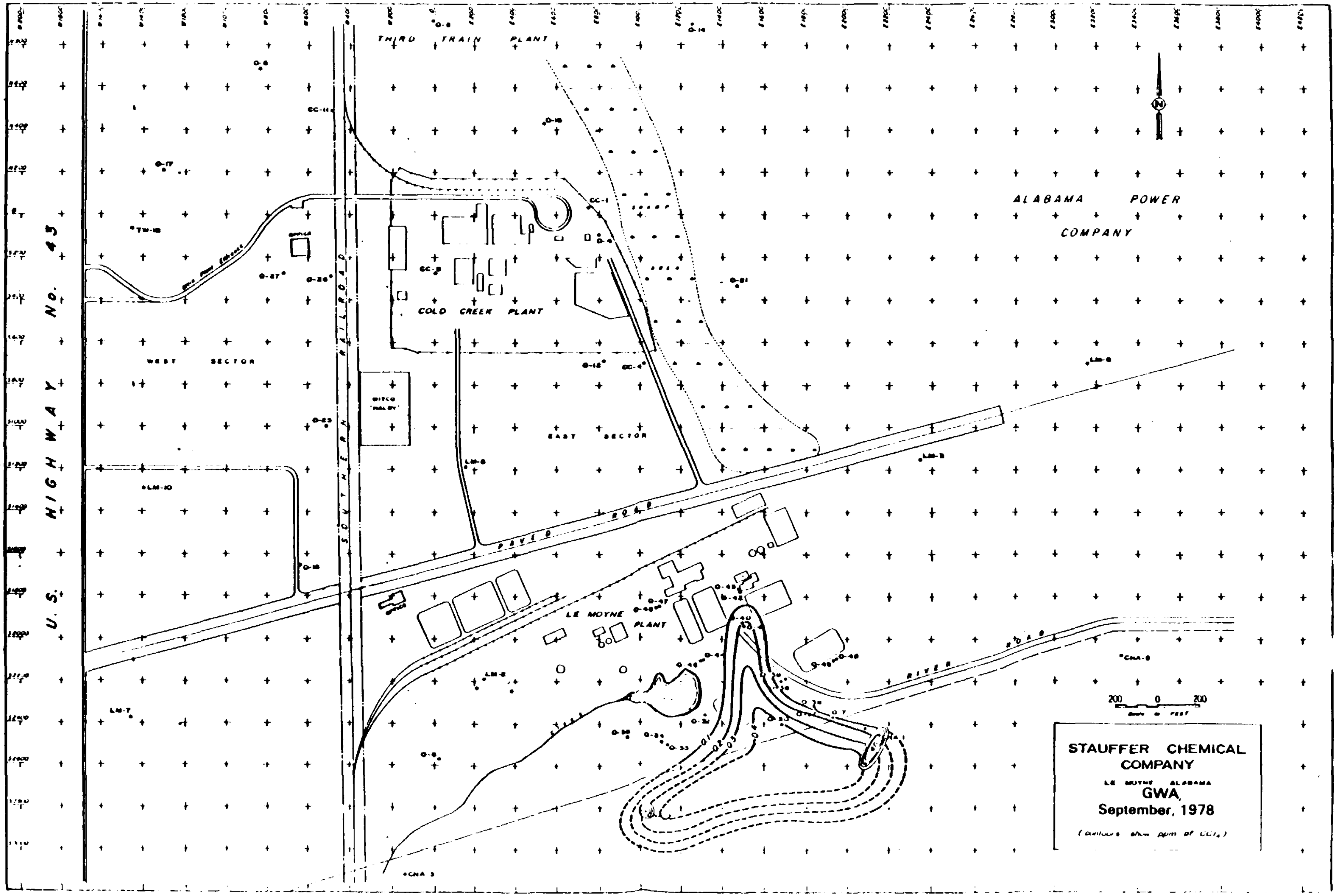


Figure 1-6 Concentration of Carbon Tetrachloride in Deep Wells

8801033

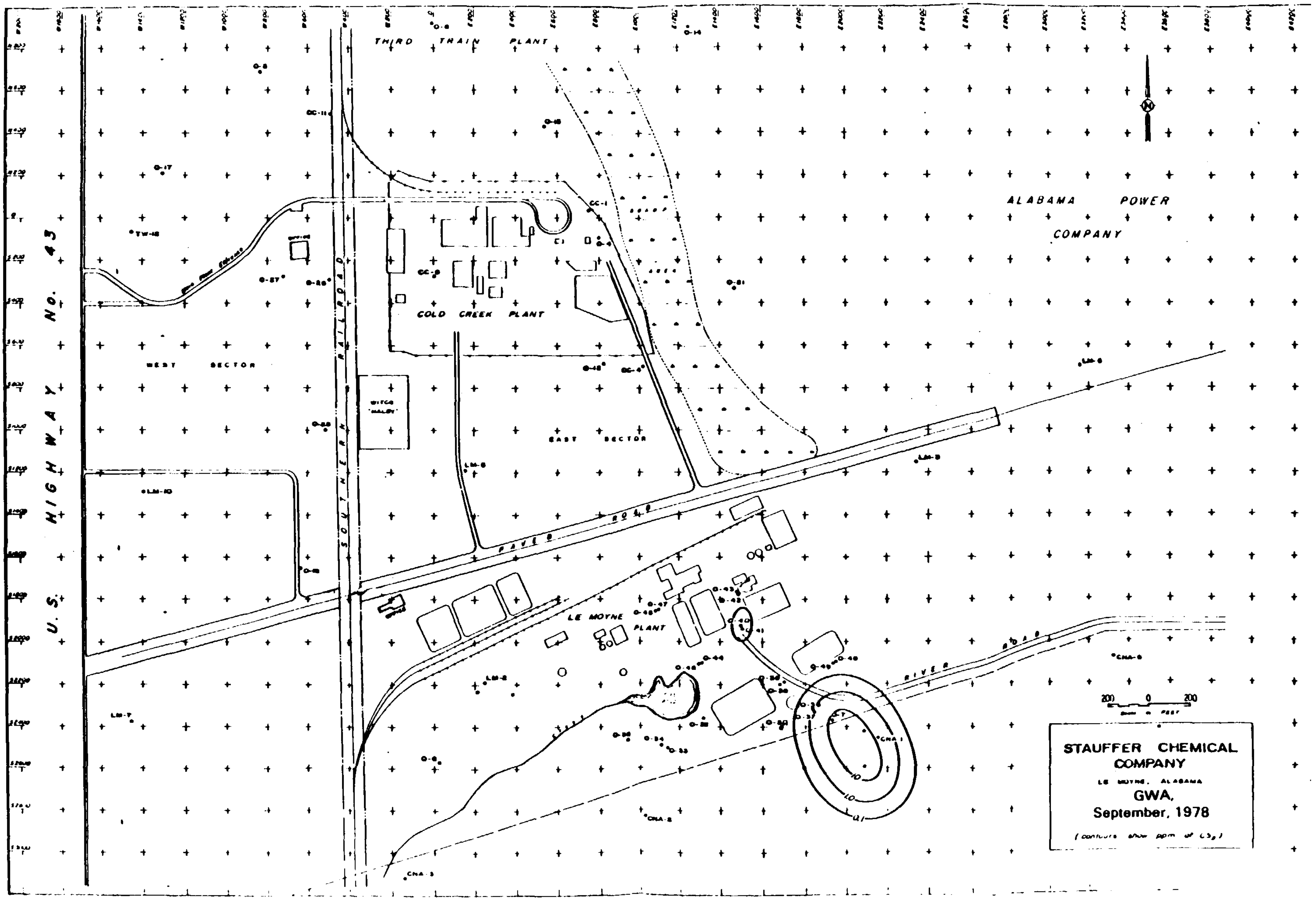


Figure 1-7 Concentration of Carbon Disulfide in Deep Wells

8801034

3 10 00081

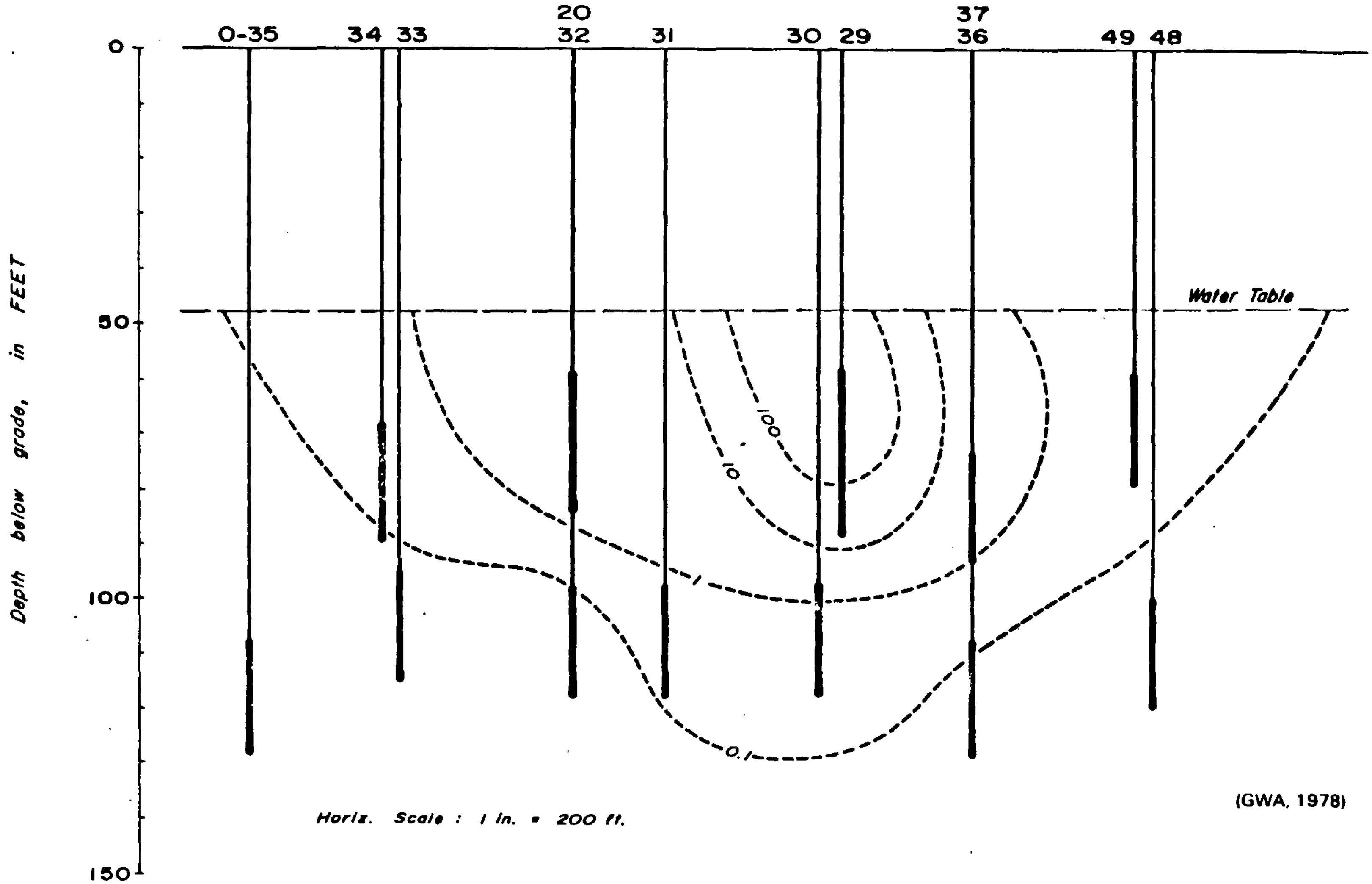


Figure 1-8 Vertical Cross Section of Carbon Tetrachloride Concentrations in East-West Plane

8801036

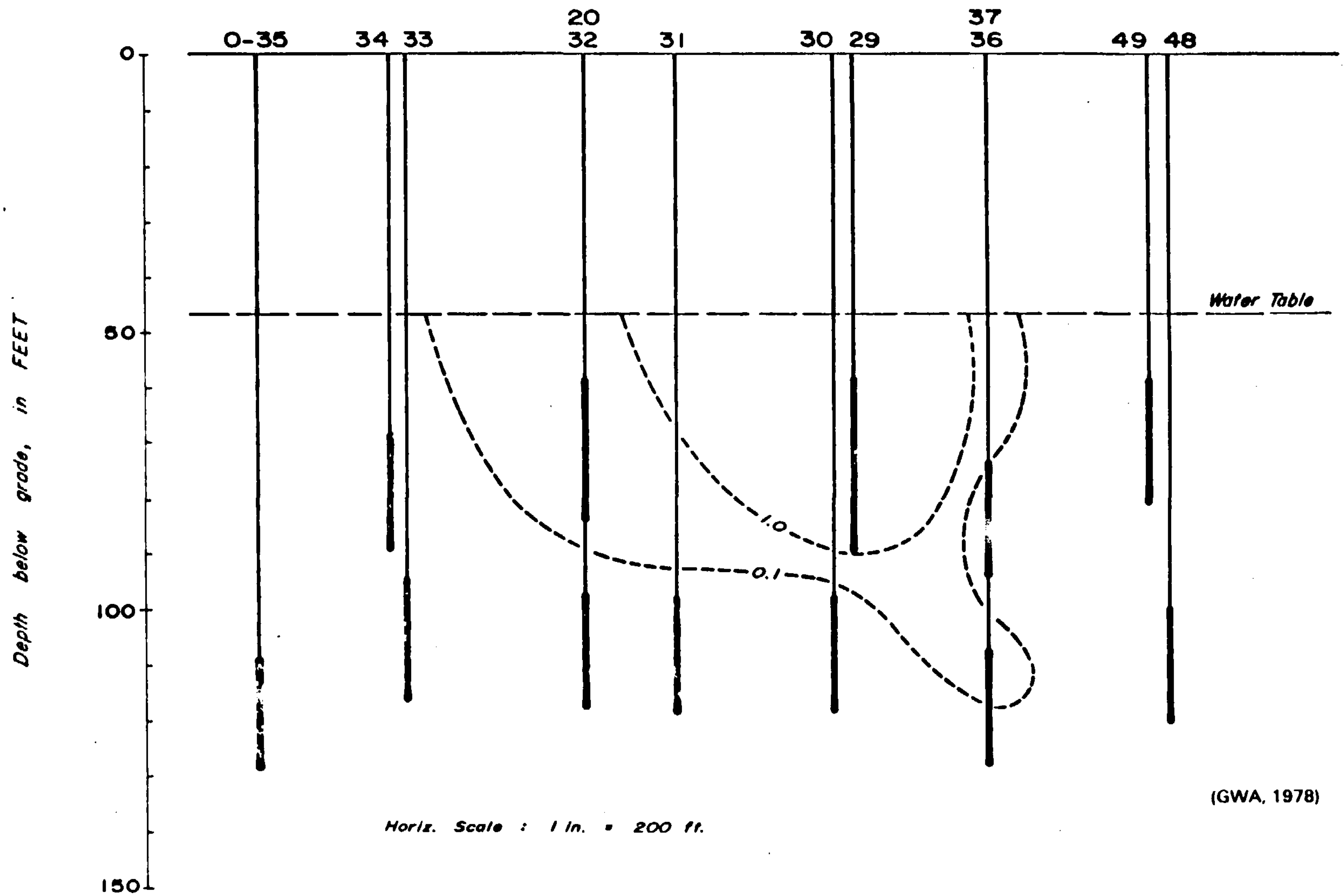


Figure 1-9 Vertical Cross Section of Carbon Disulfide Concentrations in East-West Plane

3 10 00082

8801036

3 10 00083

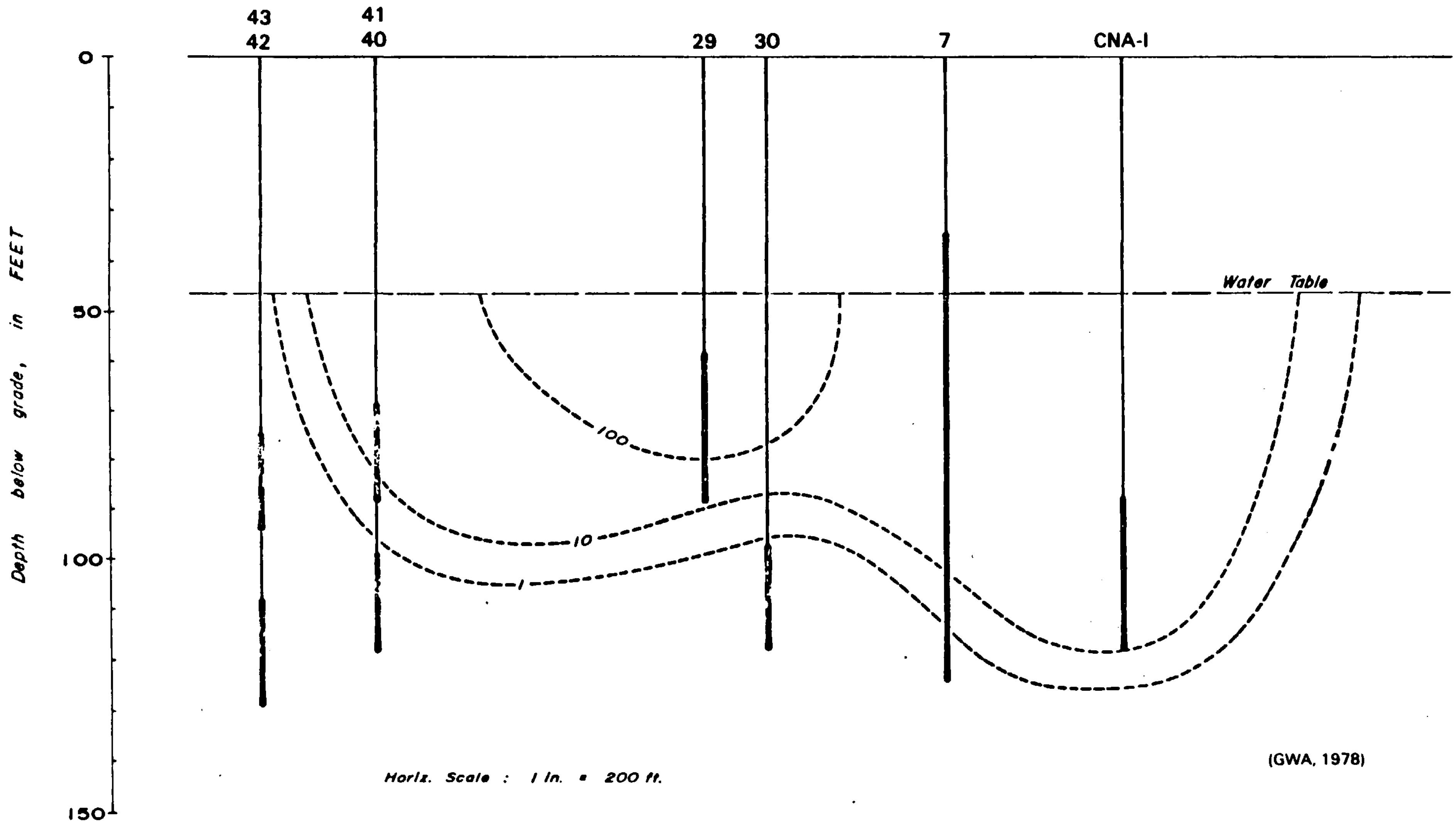


Figure 1 10 Vertical Cross Section of Carbon Tetrachloride Concentrations in North to South-Southeast Plane

8801037

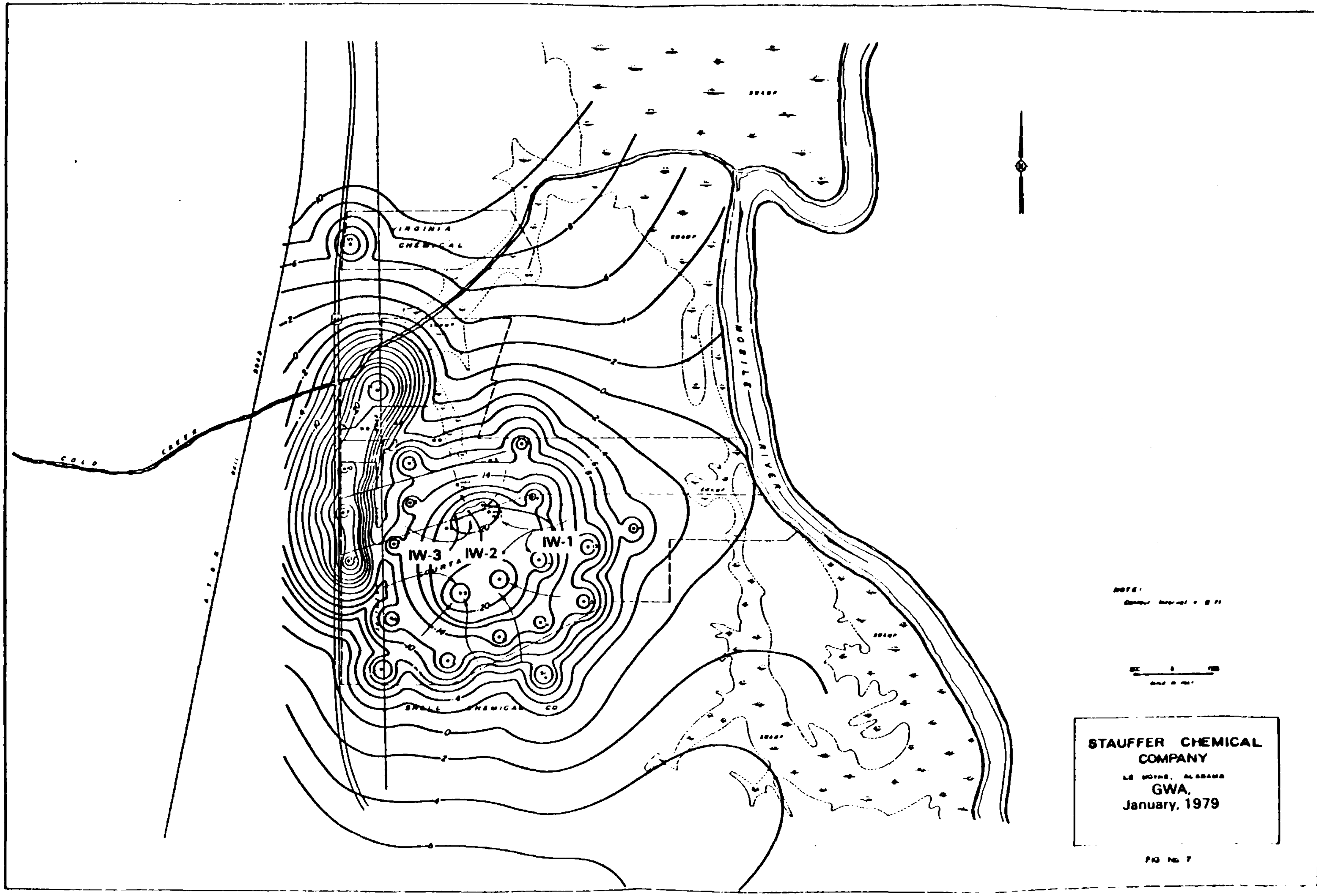
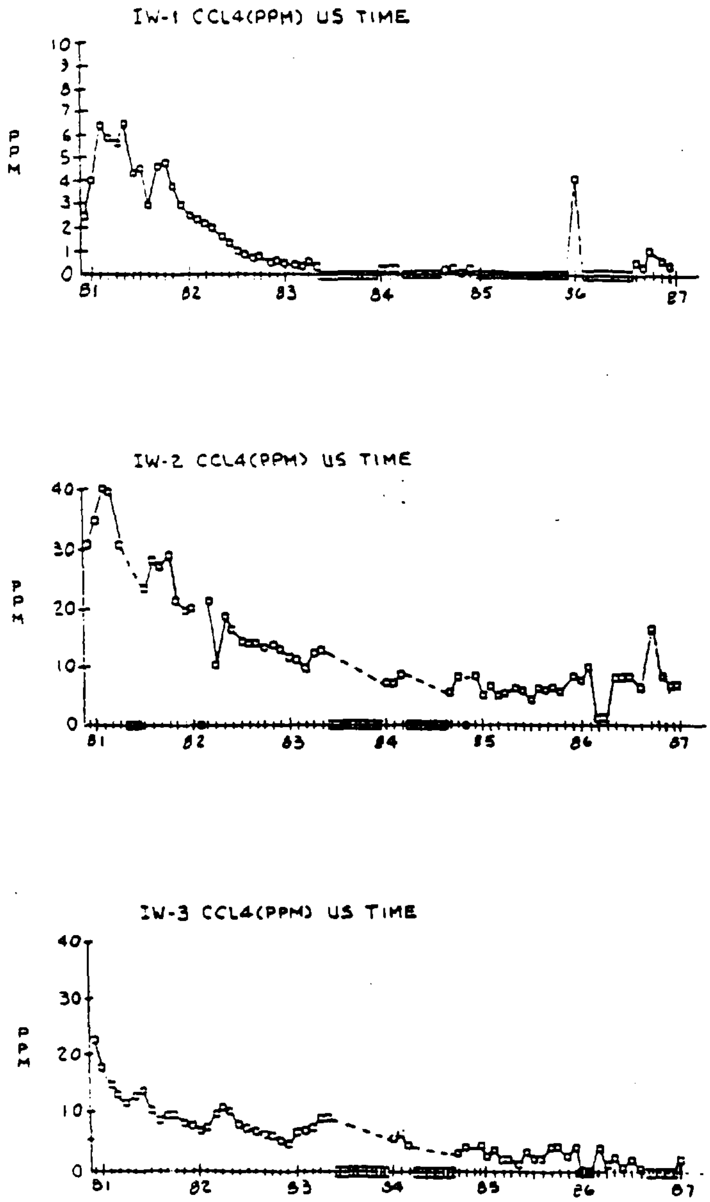


Figure 1-11 Contour Map of Piezometric Surface

0 10 00084



STAUFFER CHEMICAL CO.
ENGINEERING DEPT. DOBBS FERRY, N.Y.
SUBSIDIARY OF Chesebrough-Ponds Inc.

DWN	DATE	SCALE
DWG NO	JOB NO	ISSUE
1.2-9	3755A0	

Figure 1-12 Carbon Tetrachloride and Carbon Disulfide Concentrations Versus Time at Ground-Water Intercept Wells

8801038

At the request of the Alabama Department of Public Health (ADPH), Stauffer installed seven new monitoring wells around the two closed Cold Creek landfills in 1980. Early in 1981, the leaking treatment and storage ponds at the LeMoyne facility were repaired.

In 1982, the ADPH, in conjunction with the U.S. Environmental Protection Agency (EPA), conducted an on-site assessment of the Cold Creek and LeMoyne facilities. Analyses of ground-water samples collected during the assessment identified ground-water contamination on the plant sites and at the CNA well that was sampled. The primary contaminants detected were metals, chlorides, carbon tetrachloride and miscellaneous organic compounds. As a result, the Stauffer sites were added to the National Priorities List (NPL) by the EPA under the mandate of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), also known as Superfund. The Cold Creek site was ranked number 204 and the LeMoyne site number 467 on the NPL. To date, there has been no extraordinary public interest in the sites.

Camp Dresser and McKee, Inc. (CDM), under contract to the EPA, conducted preliminary sampling at the site in May of 1985 and prepared a Work Plan for performance of a Remedial Investigation/Feasibility Study (RI/FS) at the Cold Creek/LeMoyne site. Stauffer performed the RI in 1986 and submitted a draft RI Report in February of 1987. In response to review and comments by the EPA, Stauffer commenced revision of the report and submitted data dated July 1, 1987. ERT, A Resource Engineering Company (ERT), was retained by Stauffer to revise the RI Report in response to additional comments from the EPA. Report revisions and responses to EPA comments have been incorporated into this document.

1.3 Remedial Investigation Summary

1.3.1 RI Objectives

The overall objectives of this Remedial Investigation were to define all potential contamination sources and to identify the extent of any contamination migration and potential transport pathways. Specific areas to be investigated included the north and south Cold Creek landfills (see Figure 5-1), the LeMoyne landfill (see Figure 5-1), nine ponds and lagoons (see Figure 5-2), and the Cold Creek and LeMoyne Swamps (see Figures 5-3 and 5-4 and Drawing 1.3 in Appendix XVII). The extent of ground-water contamination was also determined. The primary objective was to obtain enough additional data to evaluate the success of past and current remedial actions and to determine the need for further measures.

1.3.2 Source and Area Characterization

In order to accomplish the objectives outlined above, the RI was divided into two major subtasks, source characterization and area characterization. Source characterization included the installation of 3-foot-deep soil borings at 34 locations in the Cold Creek Swamp and at four locations in the LeMoyne Swamp. Of these 38 composite samples, 7 were analyzed for thiocarbamates, chlorides, and priority pollutants, and 31 were analyzed for mercury only. A second, deeper sampling program for mercury in the swamp was considered if interpretation of the initial results indicated that it was necessary. Following receipt of Stauffer's report of November 12, 1986, which included supporting findings that the swamp recharges the ground water (see Appendix XX), EPA agreed that the Phase II sampling was not necessary.

Soil sampling was also performed under each of the nine ponds and three landfills on site. Soil borings were installed at 45-degree angles beneath the ponds and landfills and advanced to 50 feet or until ground water was encountered. Composite samples were collected at 10-foot depth increments and analyzed for location-specific compounds and priority pollutants. A total of twelve soil borings were installed under the three landfills, and a total of eighteen soil borings were installed under the nine ponds. Water samples were collected from three active ponds and analyzed for priority pollutants. Samples of the liner membrane material covering the landfills were taken and tested for integrity. In addition, fish samples from five locations in the Cold Creek Swamp were collected and analyzed for mercury. Source characterization was completed with the installation and sampling of two new ground-water monitoring wells and sampling of thirteen existing wells. All fifteen well samples were analyzed for priority pollutants; three of the fifteen samples were also analyzed for site-specific compounds.

Area characterization involved sampling 36 site-area wells for location-specific compounds. Seven of the 36 samples were analyzed for priority pollutants. In addition, two surface-water samples and two soil samples were collected offsite to determine background concentrations of the compounds of concern.

All the samples were collected between May and August, 1986 by Stauffer's Research personnel working with a Stauffer geologist and representatives of the EPA and EPA's contractor. Sampling, field quality assurance, chain of custody procedures, and all analytical methodology were submitted to the EPA on August 9, 1985 in Stauffer's Sampling and Analysis Manual, which was approved for use by the EPA.

All laboratory analyses were performed by Environmental Testing and Certification, Inc. (ETC). The data were reviewed and compiled by Stauffer Research. The complete laboratory data packages are included in Appendices I through V. A discussion of sampling, analysis, quality assurance and quality control is presented in Appendix VI.

In the discussion of quality assurance in Appendix VI, it is concluded that four common laboratory contaminants, methylene chloride, toluene, bis (2-ethylhexyl) phthalate and di-n-butylphthalate, which were reported in many samples near or below their detection limit, should be considered invalid because they were found in one or more blanks at concentrations near or below the method detection limits. Also considered suspect are samples reportedly containing levels near the detection limits of chloroform, trichloroethylene, cyanide, copper and zinc because they were also found at similar levels in field blank samples. For these reasons, all analytical results considered invalid or suspect are reported as non detectable throughout this report. As previously mentioned, nevertheless, all of the analytical results are included in Appendices I through V.

Results of the soil, biota, surface-water, and ground-water sampling and analysis conducted during the RI are summarized in Tables 1-1 through 1-3. Only those compounds detected are included in these tables.

The following is a list of tests and/or samples either not taken or relocated, and the reason for the deletion or move (see Figures 5-1 and 5-2 for location).

1. Phase II swamp sampling was not conducted because of decision by EPA to omit as unnecessary.

2. Relocated soil boring MTP 2-S to southeast corner of covered pond because of proximity to high voltage power lines.

3. OCTC-1S moved to west end of WWT pond to minimize damage to dike.

4. Reversed locations of OCTC-2S and OCS-1S to avoid potential damage to pond banks and covers.

TABLE . . . C ANTS DETECTED IN COMPOSITE SOIL SAMPLES IN PONDS, LAGOONS, AND LANDFILLS AT THE COLD CREEK/LE... SITE, MOBILE COUNTY, ALABAMA

Sample:	Cyanide	Mercury	Methylene Chloride	Toluene	Fluoranthene	Pyrene	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Nickel	Selenium	Thallium	Zinc	Vanadium
Ponds:																		
*New CTC Pond																		
NCTC-1S	nd	nd	3.0600	nd	nd	nd	nd	4.0000	0.1300	nd	23.0000	4.0000	5.8000	1.8000	nd	nd	15.0000	
NCTC-2S	nd	nd	2.9900	nd	nd	nd	nd	nd	0.1500	nd	100.0000	4.6000	nd	6.2000	nd	nd	21.0000	
*LeMoyne Pond																		
LLP-1S	nd	nd	3.1400	nd	nd	nd	nd	nd	0.0810	nd	6.5000	2.2000	5.4000	1.7000	nd	nd	10.0000	
LLP-2S	nd	nd	3.1600	nd	nd	nd	nd	nd	0.2100	nd	10.7000	3.2000	6.5000	2.5500	nd	nd	11.5000	
*Cold Creek Pond																		
CCAP-1S	0.5000	nd	nd	nd	nd	nd	nd	2.0000	0.0885	nd	8.4500	2.9000	nd	1.4000	nd	nd	7.9500	
CCAP-2S	nd	nd	nd	nd	nd	nd	nd	1.0000	0.1200	nd	7.4000	2.3000	nd	1.6000	nd	nd	5.3000	
Acid Plant WWT Pond																		
APP-1S	nd	nd	nd	nd	nd	nd	nd	1.0000	0.2000	nd	12.0000	4.2000	7.2000	1.2000	nd	0.5000	14.0000	
APP-2S	nd	nd	nd	nd	nd	nd	nd	1.5000	0.1600	nd	10.4500	3.7500	7.7500	1.2500	nd	nd	8.7500	
Old CoPlant WWT Pond																		
MTP-1S	nd	1.4000	nd	nd	nd	nd	nd	nd	0.0430	nd	4.5000	2.3000	4.9000	nd	nd	nd	9.7000	
MTP-2S	nd	24.0000	nd	nd	nd	nd	nd	nd	nd	nd	8.6000	3.3000	5.8000	1.6000	nd	nd	12.0000	
Old CTC WWT Pond																		
OCTC-1S	nd	nd	0.9700	nd	0.1625	0.1345	7.6500	nd	nd	nd	5.2500	12.2000	nd	1.2500	nd	0.2500	5.9000	
OCTC-2S	nd	0.3000	nd	nd	nd	nd	31.0000	1.0000	0.0780	nd	15.0000	3.4000	nd	2.8000	nd	nd	11.0000	
Old CS2/CTC WWT Pond																		
OCS-1S	nd	0.4000	nd	nd	nd	nd	32.0000	7.0000	0.0980	nd	14.0000	15.0000	nd	2.6000	nd	nd	15.0000	
OCS-2S	nd	nd	nd	nd	nd	nd	26.5000	2.5000	0.1200	nd	14.5000	9.8500	nd	8.7000	nd	nd	29.5000	
LeCreek WWT Pond																		
CCLP-2S	nd	nd	1.2850	nd	nd	nd	nd	2.0000	0.3000	nd	12.6000	4.1500	nd	2.8000	nd	nd	12.5000	
CCLP-1S	nd	nd	nd	nd	nd	nd	nd	1.0000	0.4500	nd	15.0000	5.0000	nd	3.6000	nd	nd	21.0000	
Malby WWT Pond																		
HTP-2S	nd	nd	nd	nd	nd	nd	nd	0.5000	0.4550	nd	13.5000	4.8500	2.2000	5.2000	nd	nd	32.0000	
HTP-1S	240.0000	0.9000	nd	nd	nd	nd	nd	2.0000	0.1100	1.6000	43.0000	442.0000	22.0000	18.0000	nd	nd	1170.0000	
HTP-3S	nd	nd	nd	nd	nd	nd	nd	1.0000	0.5100	nd	15.0000	4.5500	nd	3.4500	nd	nd	25.0000	
Landfills																		
LeMoyne Landfill																		
LLF-1S	nd	0.1000	nd	nd	nd	nd	26.0000	nd	0.0290	nd	48.5000	54.5000	5.2500	3.8500	nd	nd	13.0000	
LLF-2S	nd	nd	nd	nd	nd	nd	7.5000	nd	nd	nd	5.3000	7.2000	nd	1.3000	0.5000	nd	6.6000	
LLF-3S	nd	0.1000	nd	nd	nd	nd	23.0000	nd	0.2400	nd	15.0000	23.0000	nd	3.8000	nd	nd	13.0000	
LLF-4S	nd	nd	0.9700	nd	nd	nd	33.0000	nd	0.0550	nd	22.0000	35.0000	nd	3.9000	nd	nd	22.0000	
LLF-5S	nd	nd	nd	nd	nd	nd	16.0000	1.0000	nd	nd	7.8000	26.0000	nd	1.6000	nd	nd	7.1000	
LLF-6S	nd	1.9000	0.7430	nd	nd	nd	11.0000	nd	nd	nd	7.1000	19.0000	nd	4.1000	nd	nd	14.0000	
LLF-7S	nd	0.1000	3.5200	5.4600	nd	nd	nd	nd	nd	nd	3.8000	15.0000	nd	nd	0.5000	nd	9.4000	
LLF-8S	nd	nd	nd	nd	nd	nd	8.6000	nd	nd	nd	5.2000	32.0000	nd	1.9000	nd	nd	8.1000	
North Brumfield Landfill																		
NLF-2S	nd	0.6000	nd	nd	nd	nd	nd	1.0000	0.1450	nd	14.0000	2.9500	nd	1.5500	nd	nd	10.3000	21.0000
NLF-1S	nd	nd	nd	nd	nd	nd	nd	nd	0.1700	nd	6.5000	2.5000	nd	1.4000	nd	nd	6.3000	8.3000
South Brumfield Landfill																		
SLF-1S	nd	nd	nd	nd	nd	nd	nd	1.0000	0.2100	nd	16.0000	4.5000	4.0000	2.1000	0.5000	nd	15.0000	26.0000
SLF-2S	nd	nd	nd	nd	nd	nd	nd	2.5000	0.7050	nd	34.5000	8.2000	nd	5.3000	0.6500	nd	35.2000	51.5000
Maximum:	240.0000	24.0000	3.5200	5.4600	0.1625	0.1345	33.0000	7.0000	0.7050	1.6000	100.0000	442.0000	22.0000	18.0000	0.6500	0.5000	1170.0000	51.5000
Average:	7.7581	0.9313	0.6399	0.1761	0.0052	0.0043	7.1694	1.0323	0.1567	0.0516	17.1339	24.6323	2.4774	3.2413	0.0694	0.0242	46.3606	26.7000
Frequency:	2/31	10/31	9/31	1/31	1/31	1/31	11/31	17/31	24/31	1/31	31/31	31/31	11/31	29/31	4/31	2/31	31/31	4/4

*ACTIVE WASTEWATER TREATMENT PONDS

NOTES:

All concentrations in ppm.
Average = C1 + C2 +.../Total number of samples.
Frequency = Number of samples where compound was detected/Total number of samples analyzed.
The average of the two samples was taken for duplicate samples.

TABL[illegible] [illegible] NTS DETECTED IN SEDIMENTS, SURFACE WATER AND BIOTA IN COLD CREEK AND LEMOYNE SWAMPS, [illegible], ALABAMA

Samples	Mercury	EPTC	Butylate	Vernolate	Pebulate	Molinate	Cycloate	Methylene Chloride	Arsenic	Beryllium	Chromium	Copper	Lead	Nickel	Zinc	Vanadium	Chloride
		THIOCARBAMATES															
Sediment Samples																	
LS-4S	0.2800	nd	nd	nd	nd	nd	nd	0.0259	nd	0.6500	50.0000	8.3000	12.0000	3.5000	55.0000		50.0000
LS-1S	0.1100	nd	nd	nd	nd	nd	0.2000	nd	nd	0.4000	19.0000	6.4000	15.0000	2.1000	12.0000		190.0000
LS-2S	0.1500	nd	nd	nd	nd	nd	nd	nd	nd	0.1100	6.2000	1.9000	nd	nd	20.0000		nd
LS-3S	0.2200	nd	nd	nd	nd	nd	nd	nd	2.0000	0.7100	24.0000	10.0000	23.0000	5.8000	131.0000		100.0000
CCS-1S	220.0000	0.0500	nd	nd	nd	0.0500	nd	nd	7.0000	0.4800	120.0000	33.0000	35.0000	49.5000	171.0000		nd
CCS-2S	190.0000	0.2000	0.3000	0.2000	nd	0.4000	0.5000	nd	5.0000	0.3100	140.0000	14.0000	nd	32.0000	312.0000		50.0000
CCS-3S	230.0000	1.0000	1.8000	1.1000	0.3000	0.9000	1.8000	nd	5.0000	0.8100	180.0000	34.0000	26.0000	56.0000	561.0000		50.0000
SW01-1S	0.9000								5.0000	0.5300	88.0000	68.0000	100.0000	5.6000	180.0000		
SW-11-1S								nd									
CCS-2-1E	1.8000																
CCS-2-1W	7.3000																
CCS-3-1W	690.0000																
CCS-3-1E	29.0000																
CCS-4-1E	58.0000																
CCS-4-2E	1.2000																
CCS-4-3E	2.0000																
CCS-4-3W	nd																
CCS-4-2W	0.1400																
CCS-4-1W	15.0000																
CCS-5-2W	12.7000																
CCS-5-1W	9.3000																
CCS-5-2E	5.3000																
CCS-5-1E	1.8000																
CCS-6-1E	4.9000																
CCS-6-1W	6.4000																
CCS-6-1W																	
CCS-6-2W	5.6000																
CCS-7-3W	0.9000																
CCS-7-2W	22.0000																
CCS-7-1W	7.7000																
CCS-7-1E	103.0000																
CCS-7-2E	35.0000																
CCS-7-3E	49.0000																
CCS-7-4E	25.0000																
CCS-7-5E	10.5000																
CCS-7-6E	17.0000																
CCS-8-1W	2.1000																
CCS-8-1E	8.3000																
CCS-8-2E	2.2000																
CCS-8-3E	1.7000																
CCS-8-4E	7.0000																
Maximum:	690.0000	1.0000	1.8000	1.1000	0.3000	0.9000	1.8000	0.0259	7.0000	0.8100	180.0000	68.0000	100.0000	56.0000	561.0000		190.0000
Average:	45.7308	0.1786	0.3000	0.1857	0.0429	0.1929	0.3571	0.0029	3.0000	0.5000	78.4000	21.9500	26.3750	19.3125	180.2500		62.0571
Frequency:	38/39	3/7	2/7	2/7	1/7	3/7	3/7	1/8	5/8	8/8	8/8	8/8	6/8	7/8	8/8	-/0	5/7
Water Samples																	
SW-01-1W	0.0002								nd	nd	nd	nd	nd				
SW-11-1W								nd						nd	0.3100	0.0002	
Maximum:	0.0002							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3100	0.0002	
Average:	0.0002							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3100	0.0002	
Frequency:	1/1	-/0	-/0	-/0	-/0	-/0	-/0	0/1	0/1	0/1	0/1	0/1	0/1	0/1	1/1	1/1	-/0
Fish Samples																	
BA-1	0.6300																
BA-2	3.1000																
BA-3	0.9100																
BA-4	1.1000																
BA-5	0.4200																
Maximum:	3.1000																
Average:	1.2320																
Frequency:	5/5																

NOTES:

All Concentrations are in ppm
Average = C1+...C2+../total no. of samples
Frequency = Number of samples where compound was detected/Total number of samples analyzed.
The average of the two samples were taken for duplicate samples

3 10 0091

TABLE 1-3. CO- ...ANTS DETECTED IN GROUND WATER AT THE COLD CREEK/LEMOYNE SITE, MOBILE COUNTY ALABAMA

Well:	Carbon Tetrachloride	Carbon Disulfide	Cyanide	Mercury	THIOCARBAMATES: EPTC	Butylate	Vernolate	Pebulate	Molinate	Cycloate	Thiocyanate	Phenol	Arsenic	Copper	Nickel	Zinc	Chloride	Bensulide	Chloroform
*SCC-CC12	nd		nd	nd								0.0059	nd	nd	0.0160	0.0630			
SCC-017-1W	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd	nd	nd	nd	0.0360	4.8000	nd	nd
SCC-05-1W	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd	nd	nd	nd	0.1700	9.7000	nd	nd
SCC-050	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd	nd	0.0220	nd	0.0520	45.0000	nd	nd
SCC-014	nd	nd	nd	nd	0.0014	nd	nd	nd	0.0022	nd		nd	nd	nd	0.0140	0.1100	16.0000	nd	nd
SCC-018	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.4000	nd	0.0110	nd	0.0130	0.0560	5.3000	nd	nd
SCC-016	nd	nd	nd	nd	0.0059	0.0013	nd	nd	0.0015	nd		nd	nd	nd	nd	0.1000	26.4000	nd	nd
0-29	298.0000	22.2000			0.0049	0.0022	0.0065	0.0019	0.0088	0.0026							390.0000	nd	nd
0-31	42.4000	55.6000			0.0056	0.0025	0.0028	ND	0.0080	0.0021							110.9000	nd	nd
0-32	0.0014	nd			0.0097	0.0030	0.0026	ND	0.0100	0.0029							35.2000	nd	nd
0-39	1.0820	nd			0.0056	0.0023	0.0032	nd	0.0085	0.0023							60.3000	nd	nd
0-41	0.8120	nd			0.0051	0.0022	0.0029	nd	0.0071	0.0022							36.3000	nd	nd
0-45	1.5200	0.3600			0.0130	0.0100	0.0087	0.0010	0.0170	0.0071							129.9000	nd	nd
0-49	nd	nd			0.0023	nd	0.0010	nd	0.0042	nd							367.0000	nd	nd
0-58	0.0011	nd			nd	nd	nd	nd	0.0030	nd							64.2000	nd	nd
0-64	0.0011	0.0002			0.0040	0.0012	0.0021	nd	0.0100	0.0018							61.5000	nd	nd
0-65	0.0012	0.0002			nd	nd	nd	nd	nd	nd							169.2000	nd	nd
0-73	0.0020	nd			0.0051	0.0014	0.0018	nd	0.0073	0.0019							159.3000	nd	nd
CCW-4	nd	0.0003			0.0013	0.0027	0.0046	nd	0.2310	0.0039							233.0000	0.0010	nd
CCW-7-1	nd	0.0005	nd	nd	0.0180	0.0135	0.0039	nd	0.0245	0.0040		nd	0.0280	nd	0.0120	0.0800	91.8000	nd	nd
MW-1	0.2245	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd	nd	nd	0.0330	0.0580	332.0000	nd	0.0515
MW-2	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd	nd	nd	nd	0.0220	22.1000	nd	0.0050
SCC-08-1W		nd			1.2000	nd	nd	nd	0.0020	nd							41.3000	nd	nd
SCC-22-1W		nd			nd	nd	nd	nd	nd	nd							123.6000	nd	nd
·SCC23-1W		nd			nd	nd	nd	nd	nd	nd							37.8000		nd
SCC-24-1W		0.0012			nd	nd	nd	nd	nd	nd							3300.0000		nd
SCC-25-1W		nd			0.0010	nd	nd	nd	nd	nd	nd						29.9000		nd
SCC-51-1W		nd			nd	nd	nd	nd	nd	nd							3.4000		nd
SCC-52	nd	nd			nd	nd	nd	nd	nd	nd							3.7000	nd	nd
SCC-78	nd	0.0002			nd	nd	nd	nd	nd	nd							20.9000	nd	nd
SCC-079		nd			nd	nd	nd	nd	nd	nd	6.0000						16.8000	nd	nd
SCC-080		nd			nd	nd	nd	nd	nd	nd	nd						6.8000	nd	nd
SCCLW-5		0.0008			0.0570	nd	nd	nd	0.0051	nd							17.4000	nd	nd
SCCLW-6		0.2320			0.0047	0.0014	0.0021	nd	0.0054	0.0013							58.4000	nd	nd
*SCCLW-7		nd			nd	nd	nd	nd	nd	nd							4.7000	nd	nd
*SCCLW-10		nd			nd	nd	nd	nd	nd	nd							7.9000	nd	nd
SCC-CC-12		nd			nd	nd	nd	nd	nd	nd							3.4000	nd	nd
CWA-3		0.0003			nd	nd	nd	nd	nd	nd							37.9000	nd	nd
CWA-6	0.0009	0.0063			nd	nd	nd	nd	nd	nd							35.9000	nd	nd
CWA-7	0.0145	nd			nd	nd	nd	nd	nd	nd							5.6000	nd	nd
CWA-9		nd			0.0021	nd	nd	nd	0.0034	nd							37.4000	nd	nd
CWA-11	0.0007	0.0005			nd	nd	nd	nd	nd	nd							17.8000	nd	nd
CWA-13		nd			nd	nd	nd	nd	nd	nd							65.6000	nd	nd
CWA-14		0.0024			nd	nd	nd	nd	nd	nd							96.6000	nd	nd
CWA-15		0.0005			nd	nd	nd	nd	nd	nd							11.3000	nd	nd
*CWA-16	nd	nd			nd	nd	nd	nd	nd	nd							3.0000	nd	nd
CWA-17		0.0454			nd	nd	nd	nd	nd	nd							4.7000	nd	nd
CWAM-1	0.0176	0.0007			nd	nd	nd	nd	nd	nd							29.4000	nd	nd
CWAM-22		nd			0.0210	0.0068	0.0075	nd	0.0260	0.0057							260.0000	nd	nd
CWAM-[illegible]		0.0010			nd	nd	nd	nd	nd	nd							6.2000	nd	nd
CWAM-[illegible]	0.0070	nd			nd	nd	nd	nd	nd	nd							21.2000	nd	nd
CWAM-30		0.0006			0.0070	0.0021	0.0020	nd	0.0260	0.0013							53.7000	nd	nd
NCTC	0.0323		nd	0.0003								0.0075	nd	nd	nd	0.0120			nd
LLP	nd		0.1320	0.0008								nd	nd	nd	0.0220	0.0230			nd
CCLP	0.0056		nd	nd								nd	nd	nd	0.0130	0.1600			nd
Maximum:	298.0000	55.6000	0.1320	0.0008	1.2000	0.0135	0.0087	0.0019	0.2310	0.0071	6.0000	0.0075	0.0280	0.0220	0.0330	0.1700	3900.0000	0.0010	0.0515
Average:	10.4200	1.5385	0.0102	0.0001	0.0270	0.0010	0.0010	0.0001	0.0081	0.0008	1.0667	0.0010	0.0030	0.0016	0.0095	0.0725	143.7686	0.0000	0.0011
Frequency:	18/33	20/51	1/12	2/13	20/51	14/51	14/51	2/51	20/51	13/51	2/4	2/13	2/13	1/13	7/13	13/13	51/51	1/47	2/54

*Drinking water wells

NOTES:

All concentrations are in ppm
Average = C1 + C2 + ... /Total no. of samples
Frequency = Number of samples where compound was detected/Total number of samples analyzed.
The average of the two samples was taken for duplicate samples.

3 0 00092

5. Relocated NLF-1S to west side of north landfill to avoid high voltage power lines.

6. Relocated SLF-1S to east side of south landfill because pipe racks prevented access from south.

7. Relocated SLF-2S to west side of south landfill because fire pump house blocked access from north.

8. CCAP-1S placed at southwest corner and oriented to northeast because of equipment access problem.

9. CCAP-2S shifted to east to cover other end of pond.

10. CCLP-2S moved to east end of north side oriented to south because of equipment access problems.

11. CCLP-1S shifted to south end of west side oriented to the east to cover other end of pond.

12. HTP-1S was stopped at 16.5 feet because recognizable waste material was encountered.

13. Additional boring, HTP-3S, was drilled approximately 20 feet east of northwest corner of former pond area to 45° angle oriented to south in order to obtain samples beneath pond.

14. Dye test was not necessary because the shallow wells, when installed, were dry.

15. Well 0-41, which is located approximately 10 feet south of well 0-40, was sampled instead of 0-40 because a crimp in the casing of 0-40 prevented this well from being sampled.

1.4 Report Overview

The balance of this Remedial Investigation Report generally follows the format as suggested by EPA in their guidance document dated June, 1985.

Chapter 1 provides information regarding site background, the nature and extent of contamination, previous investigative and remedial activities, and a summary of the RI site investigation program.

Chapter 2 provides information on population density and distribution, land use, natural resources, and climate.

Chapter 3 provides information on the types of wastes disposed of in the landfills, ponds and lagoons, and swamps on site, as well as the toxicity and environmental behavior of the waste components.

Chapter 4 describes the environmental setting of the site and its surroundings. The surface characteristics, including physiography, topography, and surface-water drainage, are described as are the subsurface features such as the soils, geology, and ground-water flow system.

Chapter 5 describes and presents summarized results of the RI sampling and analysis program, which involved source and area characterization. Soil, surface-water, ground-water, and biota results are presented. Complete laboratory analysis results can be found in Appendices I through V.

Chapter 6 deals with the public health and environmental concerns associated with the site. Contaminant migration pathways, potential receptors, and potential impacts on public health and the environment are discussed.

Chapter 7 describes the remedial action alternatives selected for preliminary assessment in the Feasibility Study and the remedial alternative screening process.

Finally, Chapter 8 provides a summary of the RI findings and conclusions.

As noted in the Draft RI Report, the Air Investigation (Chapter 6 of the Draft RI Report), was essentially eliminated because air testing was not as relevant and was not included in the EPA contracted Work Plan. For this reason, Chapter 6 of the Draft RI Report is not included in this document. In addition, Chapter 8 of the Draft Report, entitled Bench and Pilot Tests, has been included as an appendix to this report (Appendix XXIII). This appendix contains a discussion of the current ground-water intercept system, including operation of the interceptor wells and treatment ponds.

3 10 00096

3. HAZARDOUS SUBSTANCES CHARACTERIZATION

3.1 Waste Types

The site contains three known closed landfills, six closed or inactive wastewater ponds (five of which were investigated during the RI), seven active ponds (four of which were investigated during the RI), and two swamps. All of these areas are identified on the site map, Figure ES-1. Detailed graphic depictions of many of these areas are included in Appendix XXVI.

3.1.1 Landfills

The LeMoyne landfill contains approximately 11,000 to 12,000 tons of brine mud from chlor-alkali production along with absorption oil and plant refuse (see Appendix XXIX). The landfill was never used for burning materials, although trash fires occasionally broke out and spread beyond the landfill. The area adjacent to and east of the landfill was used to store acid brick and fire brick, blasting sand, and raw sulfur recovered from leaks which occurred along the sulfur transport line from the Mobile River to the plant. The sparseness of vegetation in the area east of the LeMoyne landfill is related to the presence of sandy soil in this area and, to a lesser extent, to the former storage of sulfur. It is unlikely that retort tower refuse is related to the lack of vegetation in this area, because retort tower refuse was stored within the boundaries of the landfill proper.

The Cold Creek plant landfills, designated north and south landfills, contain the following solid waste:

- Water treatment plant sludge,
- Used sandblast grit,
- Generator coke,
- Incinerator ash, and
- Filter aid waste.

The filter aid waste is the only material from the above list that would contain pesticides. Analytical data have shown that the total pesticide content typically found in this material is approximately 10 ppm. There could also be some solvents and other organic compounds in the filter aid waste.

Although drummed liquids were temporarily placed in the Cold Creek landfills, they were removed prior to closure. It is possible, however, that leakage or spillage of pesticides may have occurred during the period the drums were in the area.

These three landfills were closed in 1974. A 20 mil plastic membrane was placed on top and along the sides of the landfills to a depth just below the bottom of the buried waste. A 12-inch layer of compacted clay topped by clean soil was added (see Appendix XXVI for graphic depictions of the landfills). Section 5.1.1 describes the soil sampling around the landfills, and subsequent sections describe the ground-water sampling results.

3.1.2 Ponds and Lagoons

Three of the active ponds, LeMoyne LeCreek, Cold Creek LeCreek, and the new carbon tetrachloride plant WWT pond, are membrane lined and used for wastewater treatment under NPDES permits. The fourth active pond, the acid plant WWT pond, is also membrane lined. All four active ponds are monitored regularly. Of the six inactive wastewater treatment ponds, four (old carbon disulfide plant WWT pond, old chlorine plant WWT pond, Halby Pond, and Cold Creek's old neutralization pond) are closed and covered (see Appendix XXVI). The old chlorine plant WWT pond was clay lined and is now filled with excavation material from the plant and fill from the plant borrow pit. The old carbon tetrachloride plant WWT pond was lined and contains approximately 1900 cubic yards of sulfur sludge. It is inactive but not closed. Section 5.1.2 describes the soil sampling around these ponds, and subsequent sections describe the surface-water and ground-water sampling program results.

3.1.3 Cold Creek and LeMoyne Swamps

The Cold Creek Swamp had received effluent from the LeMoyne and Cold Creek plants as well as from a plant owned by a previous tenant, the Halby Chemical Company (HCC). The effluent from the LeMoyne plant consisted of process waters from production units, containing 10 parts per million of mercury. Strong evidence indicates that the mercury present in the swamp is insoluble and immobile, and is therefore present as a sulfide. (See Appendix XXV for a detailed explanation of why the mercury in the swamp is in the form of mercury sulfide.) Neutralized waste brine from the Cold Creek plant was also discharged to the swamp during the late 1960's and early 1970's. The contribution from the HCC was presumably thiocyanate-contaminated wastewater.

The LeMoyne Swamp may have received surface-water runoff from the area of the LeMoyne landfill prior to its closure. Section 5.1.3 describes the soil sampling around these swamps, and subsequent sections describe the ground-water sampling results.

3.2 Waste Component Characteristics and Behavior

The major waste components found during the RI site investigation were mercury, carbon tetrachloride, carbon disulfide, cyanide (one isolated sample), thiocyanate, and six thiocarbamates (EPTC, butylate, vernolate, pebulate, molinate and cycloate). A few other heavy metals were found in soil samples, but their concentrations were in the range commonly found in natural soil or slightly higher. These data, as well as other laboratory analyses of environmental media, are contained in Tables 1-1, 1-2, and 1-3, which are included in Section 1.3.

The environmental behavior and toxicity assessment of each of the major waste components are described in the following sections. Appendix XIX provides some empirical toxicity information for each major waste component; in addition the Endangerment Assessment (separate report) contains detailed toxicological profiles.

3.2.1 Mercury

3.2.1.1 Environmental Behavior

The major removal mechanism of mercury from natural water systems is adsorption onto the surfaces of particulate phases and subsequent settling to the bed sediment. According to the EPA (1979), the overwhelming majority of any dissolved mercury is removed in this manner within a relatively short time, usually in the immediate vicinity of the source.

Photolysis seems to be significant in the chemical speciation of mercury in the atmosphere and perhaps in the aquatic environment. Because of the limited amount of information available regarding this process, however, it is not clear what impact it may have on the overall fate of mercury in the aquatic environment. Because of its uniquely high vapor pressure relative to other metals, metallic mercury can enter the atmosphere from the aquatic environment in the form of several different gaseous compounds. This factor makes volatilization important for the aquatic fate of mercury. It is not clear what impact volatilization will have on the overall fate of mercury in the aquatic environment, however, because of the limited quantitative data available regarding the volatilization of mercury compounds from natural waters.

EPA's (1979) review of environmental studies and theoretical considerations indicates that mercury adsorption onto sediments is probably the most important process in determining the fate of mercury in the aquatic environment. Carr and Wilkness (1972) found that radioactive mercury, when added to natural samples, was rapidly apportioned out of the particulate phases with half-lives for adsorption ranging from less than one to fifty hours. Ramamoorthy and Rust (1976) conducted laboratory studies on mercury sorption and found that sorption rates were highest in organic-rich sands, that sediment binding capacity was most closely related to organic content, and that mercury sorption was little affected by pH. In their study of mercury adsorption on and desorption from sediments, Reimers and Krenkel (1974) found that, at a constant pH, the adsorption of inorganic mercury is affected by aquatic chloride concentration, with the percent loss in capacity depending upon the constituents of the sediment. They also found that inorganic mercury is bound strongly enough by sediments to be transported by sedimentary mobilization.

Because of the concern regarding the danger to human health from eating mercury-contaminated fish, the bioaccumulation of mercury in the aquatic environment has been well studied. Methyl mercury is the form of mercury present in most fish tissue, and it is the most readily accumulated and retained form of mercury in aquatic biota. Methyl mercury is readily accumulated by fish both from their food and through water, and is very difficult to eliminate after entering the biological system. Most studies report that the half-life of methyl mercury in aquatic organisms is between one and three years.

As an element, mercury is not intrinsically altered by chemical reaction, but it does take part in biologically-mediated reactions which drastically alter its mobility and toxicity. According to the EPA (1979), virtually any mercurial compound can be microbially converted to methyl mercury upon entering an aqueous system. Conditions reported to enhance the methylation process include large amounts of available mercury, large numbers of bacteria, absence of strong complexing agents such as sulfide, circumneutral pH, high temperature, and a moderately aerobic environment. (As discussed in greater detail in Appendix XXV, conditions at the Cold Creek/LeMoyne site did not favor the formation of methyl mercury. Rather, conditions favored the precipitation of insoluble mercury sulfide because of the presence of the strong complexing agent, sulfide.) Bacteria can act not only as mediators of methylation, but can also preferentially accumulate large amounts of mercury. Although sediment is probably the most important sink for mercury, methylation by bacteria could reduce the mercury content of overlying waters, resulting in the mobilization of inorganic mercury from the sediments. In summary, mercury can be metabolized by bacteria to methyl and dimethyl forms which are quite mobile in the environment.

3.2.1.2 Toxicity Assessment

Exposure to mercury in most forms is associated with a high degree of toxicity. Chronic exposure to elemental (metallic) mercury causes behavioral effects and other nervous system damage. Inorganic mercury salts do not generally reach the brain, but will produce kidney damage. Organic mercury compounds are toxic because they can cross the blood-brain barrier and produce nervous system disorders.

The metabolism, distribution, and excretion of mercury depends largely on its chemical form. Preferential deposition of elemental mercury vapor occurs in the lungs. Organic mercury is efficiently absorbed by the gastrointestinal tract based on its ability to traverse biological membranes. Both elemental and organic mercury break down in the body to the more toxic form, divalent mercury.

In a review of carcinogenic data for either inorganic mercury or methyl mercury, the EPA (1984) noted that none of the available data indicated "carcinogenic potential". The federal maximum contaminant level (MCL) is 0.002 mg/l.

3.2.2 Carbon Tetrachloride

3.2.2.1 Environmental Behavior

Volatilization is the major transport process for carbon tetrachloride in aquatic systems because of its high vapor pressure. There is little information specifically pertaining to adsorption of carbon tetrachloride onto sediments. McConnell et al. (1975) found that coarse gravel had little adsorptive capacity for carbon tetrachloride, whereas sediments rich in organic detritus had a much higher adsorptive capacity. In general, however, there is no clear evidence of selective concentration of carbon tetrachloride in sediments.

Neely et al. (1974) have shown that bioaccumulation is directly related to the logarithm of the octanol/water partition coefficient (log K_{ow}) of the compound. The log K_{ow} of carbon tetrachloride is 2.64, indicating a tendency for this compound to bioaccumulate under conditions of constant exposure. Pearson and McConnell (1975), found that although carbon tetrachloride and other organochlorines examined are somewhat lipophilic and tend to be found at higher concentrations in fatty tissues, there is no evidence for the biomagnification of carbon tetrachloride or other short-chain aliphatics in the food chain. According to the EPA (1979), however, the difficulties associated with the analytical methods in the Pearson and McConnell (1975) study make estimates of bioaccumulation based on their experimental results somewhat unreliable.

There is little information specifically pertaining to biodegradation of carbon tetrachloride. Thom and Agg (1975) have included carbon tetrachloride on a list of synthetic organic chemicals which should be degradable by biological sewage treatment methods provided suitable acclimatization can be achieved. They note, however, that not many compounds on the list occur free in nature, and, therefore, it is unlikely that microorganisms already possess the ability to destroy them.

3.2.2.2 Toxicity Assessment

The toxicity of carbon tetrachloride can be accounted for because it is a fat-soluble, halogenated hydrocarbon. Absorption of carbon tetrachloride through dermal and inhalation routes is greater than through ingestion routes. Again, because of carbon tetrachloride's fat-soluble nature, it is readily absorbed through the skin. Distribution of carbon tetrachloride is body-wide with the highest concentrations found in fat tissues, liver, bone marrow, and blood (EPA, 1984a). Carbon tetrachloride is metabolized into chloroform and a trichloromethyl radical in the liver.

The EPA (1984b) noted that, although the majority of several mutaginecity assays were negative, there was evidence supporting the classification of carbon tetrachloride as a weak mutagen.

Carbon tetrachloride is classified as a group "B2" carcinogen in the EPA's weight-of-evidence ranking scheme (SPHEM, 1986). This category indicates that there is sufficient evidence for causing liver cancer in animals but that the corresponding human data is inadequate. The federal MCL, for an incremental increased lifetime cancer risk of 1×10^{-6}, is 0.005 mg/l.

3.2.3 Carbon Disulfide

3.2.3.1 Environmental Behavior

Very little information is available regarding the transport and fate of carbon disulfide. Nevertheless, data regarding the physiochemical properties of carbon disulfide (Verschueren, 1983) can be used to qualitatively assess the processes that may be important in determining its fate. Carbon disulfide has a relatively low boiling point and high vapor pressure, indicating that it is very volatile. It has a specific gravity of 1.263 and is therefore more dense than water. With a solubility of 2300 mg/l, it is very soluble in water from an environmental perspective. The octanol-water partition coefficient of carbon disulfide is in the range of from 69 to 145, indicating that it is not readily adsorbed to soils. Given this information, it is likely that volatilization and ground-water mobility are significant whereas adsorption is of lesser importance in terms of the transport of carbon disulfide. The significance of photolysis, hydrolysis, bioaccumulation, and biotransformation cannot be assessed with the information available from Verschueren (1983) regarding the chemical and physical properties of carbon disulfide.

3.2.3.2 Toxicity Assessment

Carbon disulfide is hazardous as a liquid and a vapor. Although inhalation is the major route of toxic exposure, exposure may be compounded by dermal absorption and ingestion. Because of its fat solubility, carbon disulfide is reported to be one of the strongest skin irritants known, causing third degree burns within minutes (Spyker et al., 1982). Skin absorption may cause localized degeneration of peripheral nerves, usually in the hands (Sittig, 1985). Inhalation of carbon disulfide vapor may also cause respiratory irritation and progress to bronchitis and emphysema. The primary manifestations of acute and chronic carbon disulfide exposure include pyscological, neurological, and cardiovascular disorders.

Carbon disulfide has been demonstrated to produce reproductive and teratogenic effects in animals when inhaled (Bariliak et al., 1975). Data on mutagenicity and carcinogenicity were not available.

3.2.4 Cyanides

3.2.4.1 Environmental Behavior

Cyanides are a diverse group of compounds whose fate in the aquatic environment varies widely. The cyanide ion (Cn) can react with a variety of metals to form insoluble metal cyanides. If the cyanide ion is present in excess, complex metallocyanides may be formed. These compounds are quite soluble and can be transported in solution. The fate of low molecular weight organic cyanides (nitriles) is expected to parallel the fate of hydrogen cyanide, a gas which may be destroyed by biodegradation or removed from solution by volatilization or adsorption.

The significance of photolysis on the aquatic fate of the cyanides has not been investigated fully, although it is possible that the photolysis of the metallocyanides could result in the release of cyanide ion (Broderius, 1977). EPA (1979) notes that this process could be important in aquatic environments downstream from metallocyanide discharges. According to the EPA (1979), the hydrolysis of nitriles in the aquatic environment is slow in most cases, and is probably not competitive with other processes.

Cyanides are fairly mobile in the soil environment (Alesii and Fuller, 1976), indicating that adsorption is probably not a significant control on mobility in most aquatic environments where sorbents (e.g., clays, biological solids, sediments) are much less concentrated. Alesii and Fuller (1976) reported that cyanide mobility is least where soils have a low pH, high concentrations of free iron oxides and positively-charged particles such as the clay minerals kaolin, chlorite, and gibbsite. Cyanide mobility is greatest at high pH, high concentrations of free calcium carbonate (high negative charge), and low clay content. According to the EPA, biological solids sorb cyanides, but, as with the other sorbents, the amount bound is probably insignificant in comparison to the amounts volatilized or biodegraded.

Broderius (1973) reported the bioaccumulation of metal (copper and silver) cyanide complexes in fish. According to the EPA (1979), it is difficult to assess the environmental importance of metal cyanide bioaccumulation other than to note that the metal cyanides are generally less toxic than hydrogen cyanide. Nevertheless, bioaccumulation undoubtedly enhances the chronic toxic effects of the metal cyanides.

Although biodegradation of cyanides is known to occur in natural waters, the rates of cyanide biodegradation have not yet been ascertained. According to the EPA (1979), the importance of this process varies according to such factors as cyanide concentrations, pH, temperature, microbe concentration and acclimatization to cyanide, and the availability of nutrients.

3.2.4.2 Toxicity Assessment

The term "cyanides" encompasses those inorganic or organic compounds which contain the CN^- group. Examples include cyanide ions that form complexes with metals, cyanates that contain the OCN^- radical, alkyl cyanates that trimerize to cyanurates, nitriles, and cyanohydrins. The toxicity of many of these substances is related to subsequent release of hydrogen cyanide (HCN) or the CN^- radical. These components can be released as a result of photodecomposition, ionization, or dissociation (Dourdoroff et al., 1966; EPA, 1980).

Cyanides are readily absorbed through the lungs, gastrointestinal tract and skin. Death from acute cyanide poisoning is the result of "cytotoxic anoxia", or cellular asphyxiation. It is one of the most rapidly acting toxins known to humans (Gilman et al., 1980).

The detoxification of cyanide in humans is extremely efficient (Klaassen et al., 1986), and therefore, chronic toxic effects of cyanides are rare. Many chronic studies have been performed in rodents and dogs, all with negative findings (EPA, 1980; EPA, 1985). There are, however, conflicting data regarding the teratogenicity of cyanides.

The Carcinogen Assessment Group of the EPA has not evaluated the carcinogencity of cyanide because there is a lack of human and animal carcinogenicity data. The EPA, therefore, has designated it as a group "D" - Not Classified Chemical.

3.2.5 Thiocarbamates

3.2.5.1 Environmental Behavior

Very little information is available regarding the transport and fate of the individual thiocarbamate compounds, or the thiocarbamate compounds as a class. Nevertheless, data from the Handbook of Environmental Data on Organic Chemicals (1983) regarding the physiochemical properties of the thiocarbamates have been used in this report to qualitatively assess the processes that may be important in determining their fate. In addition, the limited amount of information available regarding the known properties of the individual compounds is reported here.

In general, the thiocarbamates have relatively low to moderate boiling points and moderate vapor pressures, indicating that they are somewhat volatile. Their aqueous solubilities range from 30 to 370 ppm, which indicates that they are soluble to very soluble in water. Given this information, it is likely that ground-water mobility is a significant factor in the fate and transport of the thiocarbamates. Because octanol-water partition coefficients were not available for these compounds, the importance of adsorption and bioaccumulation could not be assessed. In addition, the significance of photolysis, hydrolysis, and biotransformation cannot be assessed with the information available from Verschueren (1983).

Limited information regarding the fate of S-ethyl dipropylthiocarbamate (EPTC) and molinate was available in the Handbook of Environmental Data on Organic Chemicals (1983). Verschueren reports a 75% to 100% disappearance of EPTC from soils in four weeks time as the result of "aquatic reactions". According to Verschueren, molinate added to tapwater decreased over a fourteen-day holding period to 40% based on recovery of isotopic carbon (^{14}C). The loss of ^{14}C was attributed primarily to volatilization. The five major organosoluble metabolites in the tapwater were molinate sulfoxide, 3- and 4-hydroxymolinate, 4-ketomolinate, and ketohexamethylene-imine. In addition, Verschueren (1983) reports that two kinds of microorganisms isolated from garden soils and rice-field drains degraded molinate completely into various hydroxy and oxidized products. Thus, it has been shown that volatilization and biodegradation are significant in terms of the fate and transport of at least one thiocarbamate.

3.2.5.2 Toxicity Assessment

The thiocarbamates are a class of compounds with multiple uses. The bioloical activity and corresponding toxicity of these compounds varies greatly and is contingent upon structure. In general, however, the thiocarbamates act upon specific biochemical components of the nervous system. They inhibit the neurotransmitter enzyme, cholinesterase. Lethal doses that effect 50% of the exposed animal population, referred to as the LD_{50}, range from 500 mg/kg to 4000 mg/kg (Gosselin _et al_., 1984). The wide range of reported LD_{50}'s may be due to the varying extent of cholinesterase inhibition by the different compounds.

Several chronic exposure studies (Stauffer Chemical data) using cycloate and molinate revealed that no neurotoxicity was observed at low doses in rodents or in higher doses in chickens. At mid-to-higher doses, chronic exposure to EPTC in rats revealed peripheral nerve and spinal cord damage. In a rat teratology study, no teratogenic effects were noted at any dosage for butylate, cycloate, EPTC, or molinate. Empirical data for the thiocarbamates are contained in Appendix XIX, and a review of the Stauffer Chemical studies and other pertinent literature is presented in the Endangerment Assessment.

3.2.6 Thiocyanate

3.2.6.1 Environmental Behavior

There is virtually no information available regarding the fate and transport of thiocyanates. According to the EPA (1979), thiocyanates (SCN^- radical) are formed from cyanides and sulfur-containing materials, and are more stable than cyanates (OCN^- radical). Solutions of thiocyanates form free hydrogen cyanide in acidic media.

3.2.6.2 Toxicity Assessment

The toxicity of the organic thiocyanates appears to be dependent upon the length of the aliphatic side chain. Methyl, ethyl and isopropyl thiocyanates and Lethane 384 are potent and rapidly acting poisons (Gosselin et al., 1984). The mean lethal dose of methyl thiocyanate fed to rats is less than 20 mg/kg (von Oettinger et al., 1936). Effects produced by these compounds include central nervous system depression with a transient period of respiratory stimulation. This may progress to death due to respiratory failure (Gosselin et al., 1984). It is known that liver enzymes liberate cyanide from these thiocyantes (von Oettinger et al., 1936), and this is probably the cause of poisoning. Butyl thiocyanate (and higher homologues) do not liberate significant amounts of cyanide in vivo (Ohkawa et al., 1973; von Oettingen et al., 1939). The mechanism for toxicity is not known for the higher thiocyanates. All thiocyanate derivatives can cause primary irritation to the skin and eyes. Undiluted solutions may produce severe cutaneous reactions (Cameron et al., 1939).

4. ENVIRONMENTAL SETTING

4.1 Physiography and Topography

The Cold Creek/LeMoyne site is located in the Piney Meadows physiographic province, which borders the Mobile River from central Mobile County down to and along the Gulf Coast of Alabama. In the site area, the province is twelve miles wide and is developed on late Pleistocene river terraces and present-day flood-plain deposits. These deposits are superimposed on, and entrenched into underlying Miocene deposits consisting of sands and clays, with the latter predominating toward the south in Mobile County.

Surface elevations range from highs of approximately 45 feet to lows of less than 10 feet in marshy areas within one-half mile of the Mobile River. Most of the area containing plant facilities (about 1 1/2 miles west of the river) is at an elevation of between 30 and 40 feet.

4.2 Surface Water

Natural drainage from several hundred acres of land, including the western part of the LeMoyne plant property, a portion of the north central part of the adjacent CNA property, and a part of the adjacent Route 43 right-of-way, forms an unnamed stream that flows in an easterly direction south of the LeMoyne plant area. This stream then turns northward and flows generally north-northwest through a 20-acre area of the Cold Creek Swamp. Flow from the marsh area joins Cold Creek, which flows northeasterly and then easterly to discharge into the Mobile River more than a mile upstream from the eastern extension of the LeMoyne plant property.

Generally, the potential for flooding in the site area is considered minimal. Although high-intensity rain storms (greater than two inches per hour) are not uncommon, they generally do not last for significant lengths of time. Based on current flood insurance rate maps, the 100-year flood zone within the site area (Zone A8 in Figure 4-1) is confined to the eastern-most section of the LeMoyne plant property adjacent to the Mobile River. The approximate area covered by the 100-year flood plain in this part of the site is 55 acres. The zone of influence of the 500-year flood plain (Zone B) is only slightly larger (narrow band) than that of the 100-year flood plain. The closed LeMoyne landfill is approximately 500 feet west of and not within the flood plain.

An extension of the present flood plain also occurs north of the site along the lower portions of Cold Creek and portions of the Cold Creek Swamp. The combined 100- and 500-year flood-plain areas are indicated as an approximate 800-foot wide band along the section of Cold Creek which flows in a northeasterly direction, with the flood plain broadening where Cold Creek begins its east-southeasterly direction of flow. The flood plain falls within but does not completely encompass the Cold Creek Swamp (see Figure 10-1 in Appendix X) and does not extend southward toward the site along the swamp area which is associated with the unnamed stream. The majority of the site, i.e., all portions of the site and surrounding properties not within the 100- or 500-year flood areas, are classified as Zone C, or areas considered as having a minimal flooding potential.

4.3 Soils

The soils encountered at the site are loamy clays with loamy clayey subsoils. Locally, poorly drained areas of organic material and mucky clays occur. The major soil type identified by the Soil Conservation Service is the Izagora-Annemaine Association with gentle to moderate undulations.

8801039

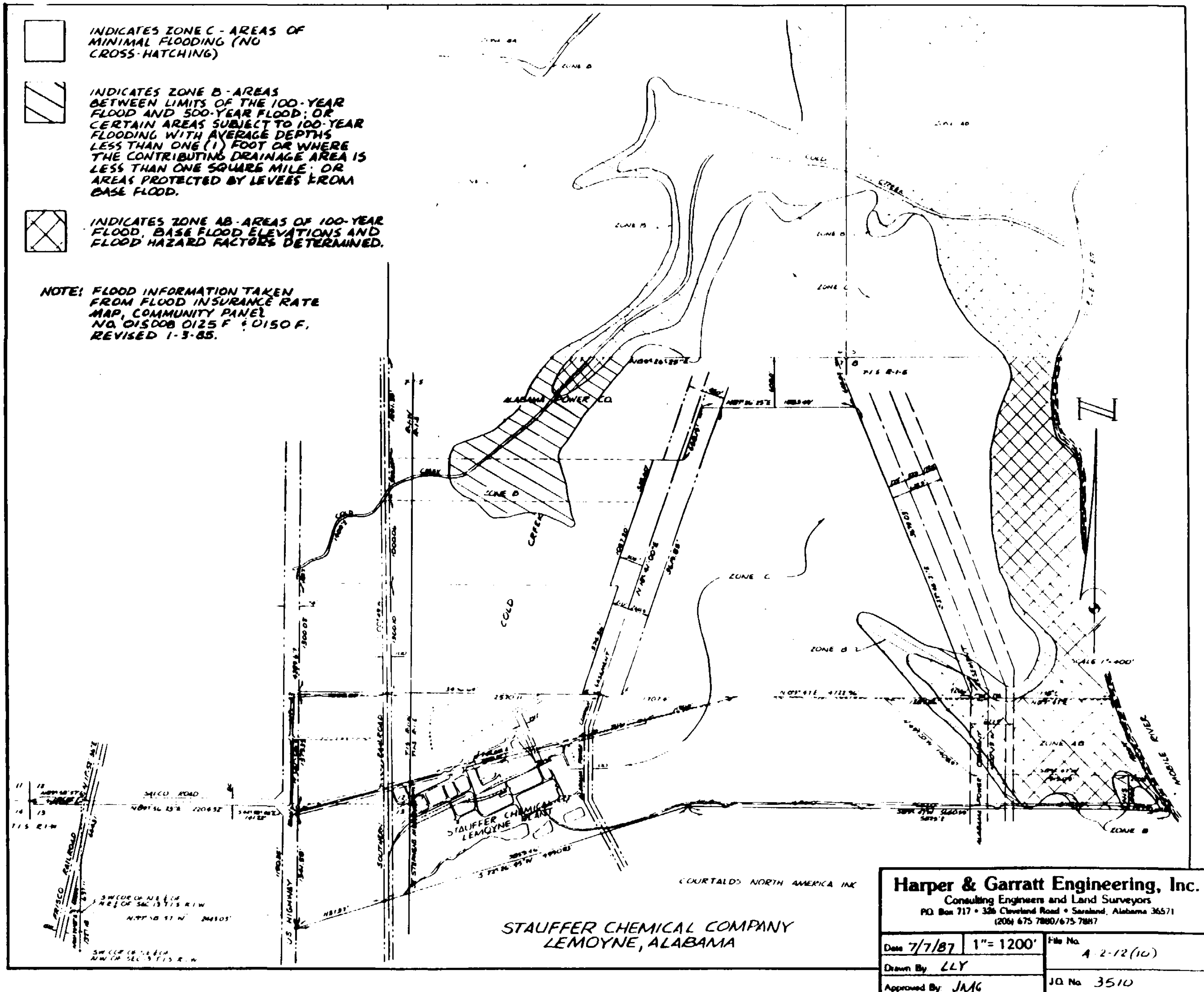


Figure 4-1 Flood Plain Map

3 10 00112

4.4 Geology

4.4.1 Regional Geologic Setting

The site is physiographically located within the Southern Pine Hills Section (Piney Meadows subsection) of the East Gulf Coastal Plain Physiographic Province. The generalized geology of the coastal plain region includes several types of Mesozoic and Cenozoic-age sedimentary rocks that occur in narrow northwest-southeast-trending bands which dip gently southward at approximately 20 to 40 feet per mile. Within the Southern Pine Hills Section of the coastal plain, the underlying sedimentary units are overlain by Miocene estuarine deposits consisting of interbedded sands and clays, and in some areas the younger Pliocene Citronelle Formation which generally consists of sand and gravel (Geological Survey of Alabama, 1968, 1971). These deposits are in many areas overlain and incised by younger Pleistocene- and Holocene-age alluvial deposits, deposition occurring from long-term sedimentation from several north-south trending streams and rivers.

4.4.2 Site Geology

The site is underlain by low river terrace and alluvial deposits that are approximately 110 to 130 feet thick. These deposits thin to approximately 60 feet adjacent to the Mobile River, which is located approximately one and one-half miles east of the central plant area. The deposits consist of generally clean, unconsolidated, fine- to very coarse-grained sands that contain some interbedded, discontinuous clayey seams as well as some gravelly zones. Table 4-1 summarizes the stratigraphic column in the site area. The upper sands, varying in thickness from 0 to 50 feet, consist of fine- to medium-grained sands, fine-grained sandy silts, silty clays, and clays. The upper sands have moderate to low permeability. The lowermost sands, situated generally between 80 feet below

TABLE 4-1

STRATIGRAPHIC COLUMN

Range of Thickness	Range of Depths Top	Bottom	Description
10-17	0	8-22	Red, yellow to brown stiff clay with basal sandy clay section pinching out locally.
0-35	10-15	11-74	Sand and clay interbeds grading laterally into sand.
14-34	8-63	30-63	Clean coarse sand with some clay interbeds.
18-45	30-74	63-102	Sand and gravel with lenses of sand or sand with some clay interbeds. Clay occurs interbedded with sand and gravel locally.
3-20	63-82	75-110	Gray sand and clay grading laterally into either sandy clay or sand.
1-23	75-110	75-115	Gray sand with some clay with lenses of sandy clay.
0-23	80-115	111-131	Sand and gravel with some clay interbeds.
	111-131		Blue clay.

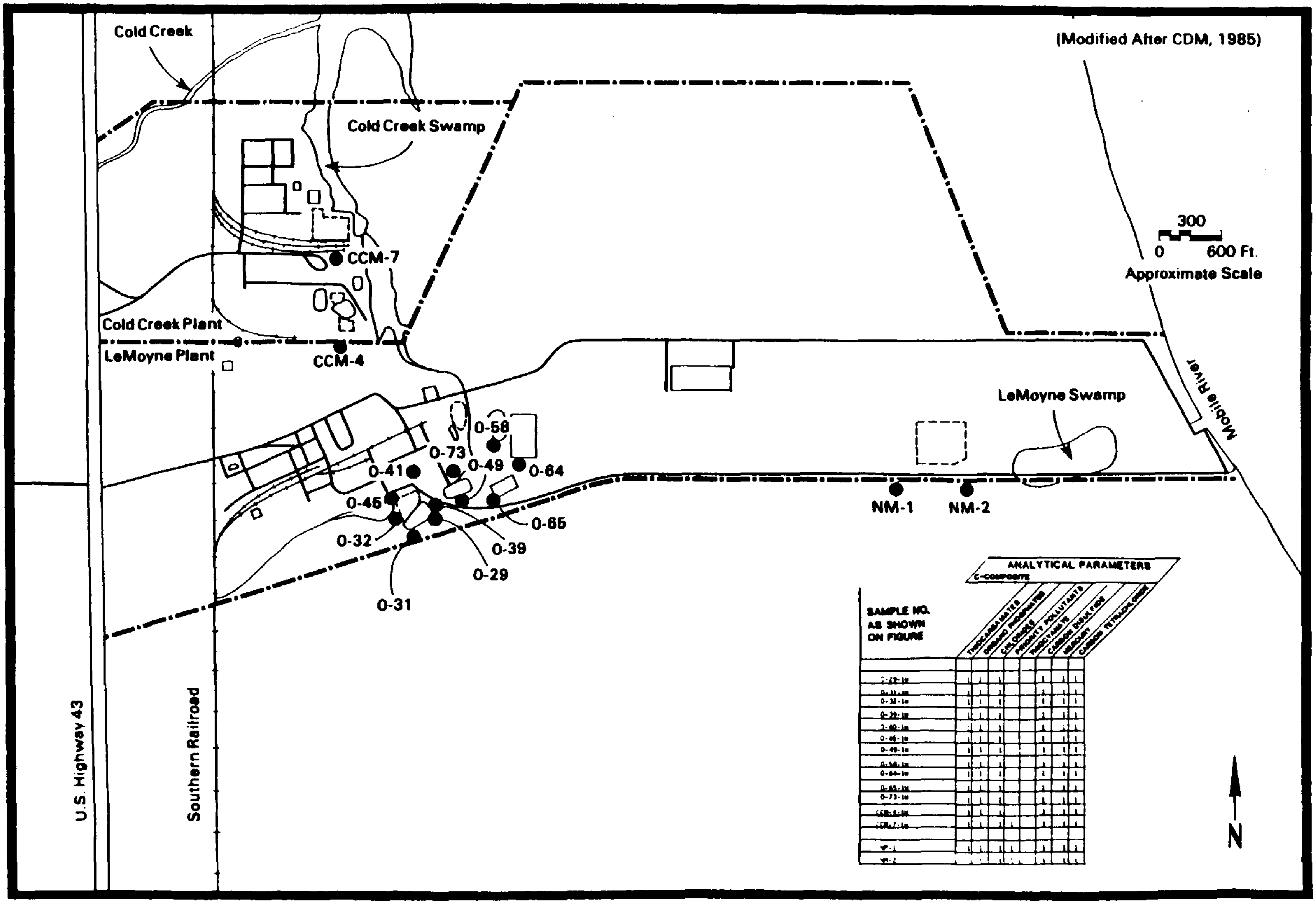
After: ERT, 1985

ground surface and the base of the aquifer, contain the most highly permeable material. A very stiff, dense, bluish-gray clay, presumably of marine origin, underlies the alluvial deposits.

Numerous test borings and well installations have been completed within the study area for various purposes (see Figures 4-2 and 4-3, and Figure 1-2). Most borings have been terminated within a unit described as a "blue clay", which has been encountered in over 50 borings across the Cold Creek/LeMoyne site, as well as the adjacent CNA property to the south. This clay unit is encountered at depths varying from 60 to 130 feet below land surface, depending upon boring location, with the average depth of the clay layer found at approximately 115 to 130 feet below land surface. The clay layer is generally described as a medium-stiff to stiff blue or blue/gray clay and is apparently overlain in some areas by a thin layer of softer yellow/brown clay. Most borings have been terminated just within this clay layer; therefore, there is relatively little information regarding its vertical extent or thickness across the site. Logs for two test borings which extend to depths below the average depth of the clay layer indicate that the layer may be at least 20 feet thick (boring O-9) and greater (boring O-28, approximately 70 feet) in some areas.

Previous studies indicate that the clay unit dips very slightly to the southwest (Stilson, 1974). The depth at which the blue clay unit has been encountered in various borings across the site is indicated in Table 4-2. This table illustrates that the clay layer is present in several areas of the site and is therefore likely to be horizontally contiguous across the site. As indicated in the Work Plan, previous studies have also suggested that the clay unit is continuous across the site and serves to isolate the alluvial deposits from other stratigraphic units below. Graphic and descriptive logs for many of the test borings are included in Appendix XXVII. Permeability testing of a single sample of the clay, collected with a Shelby tube from boring O-86 at a depth of 118

8801040

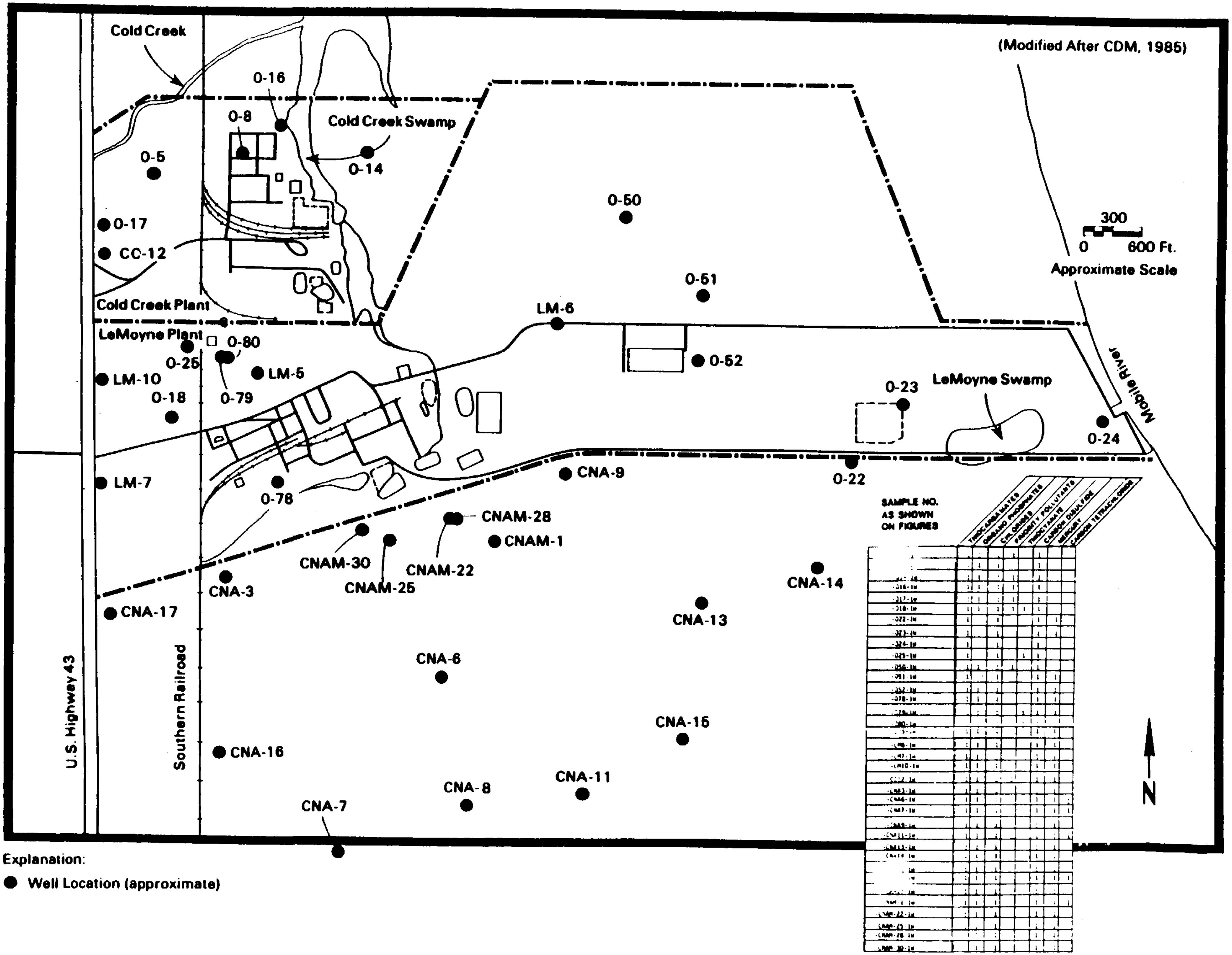


Explanation:

● Well Location (approximate)

Figure 4 2 Source Well Sample Locations

3 10 00116



Explanation:

● Well Location (approximate)

Figure 4-3 Area Well Sample Locations

3 10 00117

TABLE 4-2

DEPTH OF BLUE CLAY LAYER

(see Appendix XXVII for well logs)

Boring Number	Depth Encountered (feet below ground surface)	Total Boring Depth (feet below ground surface)
0-5	118	120
0-6	132	136
0-8	121	122
0-14	115	120
0-21	117	120
0-22	100	105
0-23	76	80
0-24	60	63
0-59	117	123
0-62	116	120
0-68	118	119
0-70	117	118
TW-12	122	124.5
0-28	123	610
0-9	121.5	461
CNAM-23	117	119
CNAM-24	125	127
CNAM-25	130	131
CNAM-26	124	126
CNAM-27	131	132
CNAM-30	130	132
CNAM-32	121	121
CNAM-34	127	128.5
0-75	124	125
0-76	112	114

to 120 feet below land surface, yielded a permeability value of 4.4×10^{-8} cm/sec.

GWA (1978) identified an intermediate clay unit in the western sector of the property. They suggest that it becomes discontinuous, thinning to the east into intermittent lenses.

4.5 Hydrogeology

4.5.1 Regional Hydrogeologic Setting

There are two principal water-table aquifers in Mobile County. A major aquifer is located a few miles west of the site in the Miocene Uplands section of the county. The second aquifer is located within the Mobile River Valley, where the site is located. This aquifer is the principal source of water for users located within the Mobile River Valley. Wells in this aquifer typically yield 470 to 846 gallons per minute (gpm), with specific capacities of 6 to 73 gpm per foot of draw down (Riccio et al., 1973).

4.5.2 Site Hydrogeology

The Mobile River Valley water-table aquifer at the site is recharged through infiltration from the Cold Creek Swamp, the Mobile River, and rainfall. The background water quality is potable, with low total dissolved solids and iron. Prior to industrialization, ground-water flow was toward the Mobile River. The ground-water table varied from 0 to 20 feet below ground level depending on the topography. Presently, however, the direction of flow is toward the south-southeast, because of the local influence of pumpage at CNA and from Stauffer's interceptor wells (see Figure 4-4). The advent of industrialization and accompanying ground-water pumpage at the CNA plant site and surrounding area has resulted in a lowering of the water table and localized changes in the direction of ground-water flow, i.e., presently, ground-water generally flows away from the Mobile River (ERT, 1984).

8801042

3 10 00120

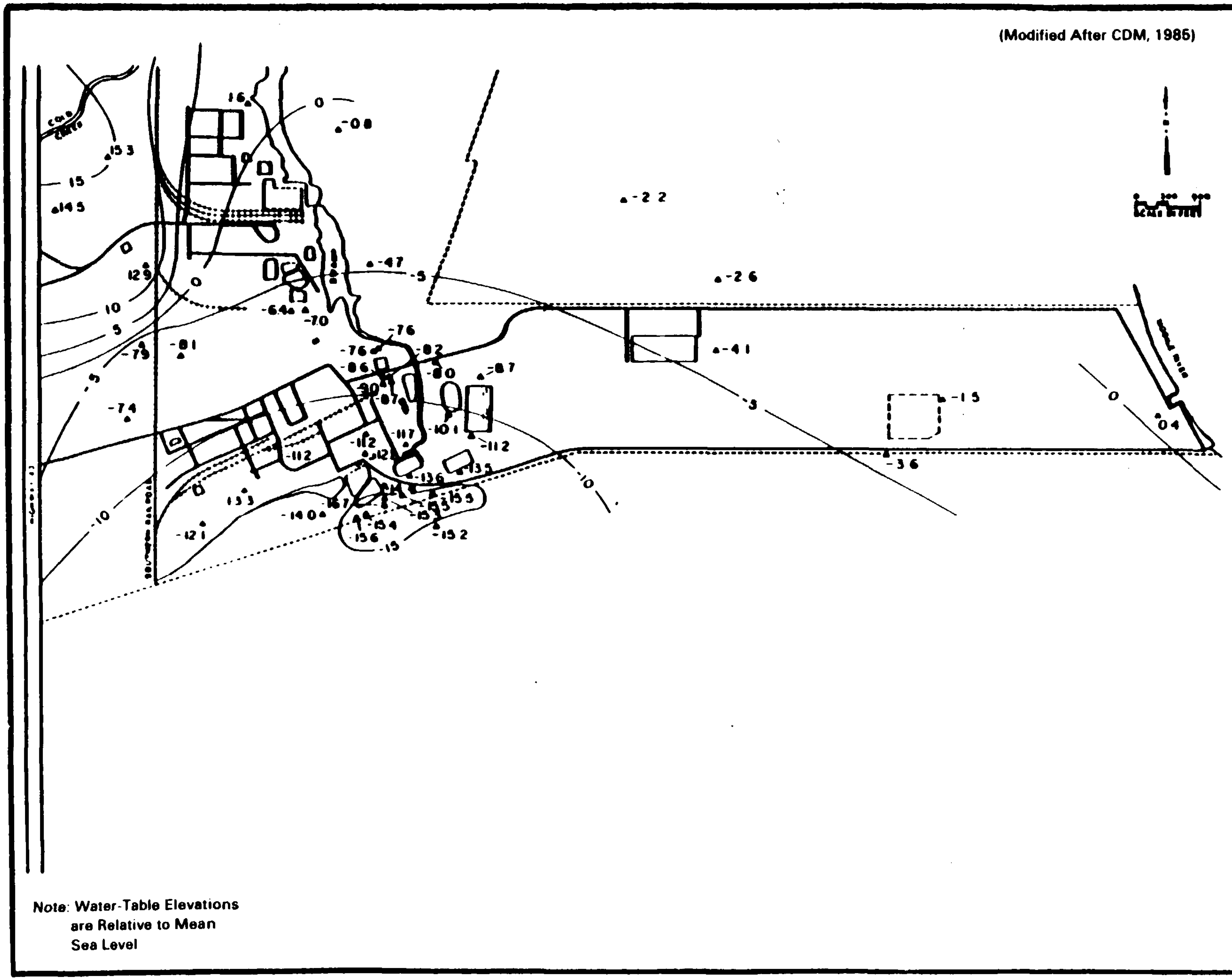


Figure 4-4 October, 1983 Water-Table Elevations

The ground-water table within the site area is generally encountered at depths ranging from 25 to approximately 75 feet below ground surface. The actual water-table depth across the site area varies according to geographic location within the site area, as well as concurrent ground-water pumping at the time of measurement. Numerous ground-water supply wells and extraction/interceptor wells which pump several hundred gallons per minute are located in the site area. A recent ground-water level sampling program was completed at the Cold Creek/LeMoyne site and adjacent CNA plant property in October, 1987. These data provide information on ground-water levels under near-stable withdrawal conditions typical of normal operations at the site. Water-level data for various wells are presented in Appendix XXVIII. These data indicate perceived normal water-table depths of approximately 40 feet below ground surface within the Cold Creek portion of the site and greater than 50 feet below ground surface within the LeMoyne plant portion of the site. Deeper water levels in the southern part of the site likely reflect higher rates of ground-water withdrawal in this area.

It is unlikely that buried wastes within any of the waste disposal areas, landfills or wastewater treatment ponds come into contact with the ground-water table under current site conditions. All of the waste disposal areas are less than 20 feet deep, and all of the landfills are less than 12 feet deep (see Appendix XXVI for graphic depictions of these areas), whereas depth to ground water varies from approximately 40 to 50 feet below ground surface within the site area. Depth to ground water under static and non-pumping conditions is not known; however, water level data in remote corners of the site area indicate water levels varying from approximately 24 to 40 feet below land surface. Therefore, even under non-pumping conditions, it is unlikely that buried wastes would come into contact with ground water.

Relatively few deep borings or well installations have been completed within the immediate site area that extend into stratigraphic units beneath the blue clay layer. Well construction information provided in Appendix XII indicates a total of eight borings which extend to a significant depth beneath the clay layer. Three of these borings represent injection wells which were drilled to depths varying from 4330 to 4750 feet below ground surface, with screens set for injection purposes at varying depths greater than 3400 feet below ground surface. Monitoring wells installed in association with the injection wells (total of five indicated) have been installed with screens at depths varying between 207 and 1160 feet below ground surface. Specific well construction details are provided within Appendix XII, and information regarding screened intervals and intended use is presented in Table 4-3. Lithologic logs available for two of the borings, IM-1 and IM-2, indicate numerous alternating layers of clay with silty fine sand and, in one case, medium to coarse sand (IM-2), extending several hundred feet beneath the blue clay layer. Both logs (Appendix XII) indicate that clay is the dominant lithologic formation encountered with relatively thin layers of fine sand or silt to depths approaching 500 feet below ground surface. Ground-water usage within the site area is believed to be limited to the upper aquifer above the clay layer.

GWA (1979) conducted aquifer pumping tests with existing production wells LM-2 and CNA-1 (see Figure 1-11) to evaluate hydraulic responses and determine aquifer characteristics in the site area. Transmissivity from LM-2 testing was determined to be 93,123 gallons per day per foot (gpd/ft), and the storage coefficient was calculated to be 0.31. Transmissivity from CNA-1 testing was 85,232 gpd/ft, and the storage coefficient was 0.15. Based on an average saturated thickness of 77 feet, the average hydraulic conductivity was calculated to be 1,100 gallons per day per square foot (gpd/ft^2).

To properly characterize the ground water in the vicinity of the LeMoyne landfill area, the Work Plan proposed the installation of two new monitoring wells downgradient of the landfill. These wells, NM-1 and NM-2, were installed to a

3 10 00123

TABLE 4-3

DEEP BORING INFORMATION

(see Appendix XII for boring logs)

Well Number	Total Depth (feet below ground surface)	Screened Interval (feet below ground surface)	Intended Use
IM-1 (0-9)	461	207-227	Monitoring well for INJ-1; first aquifer beneath blue clay
IM-2 (0-28)	610	580-590	Monitoring well for INJ-2; aquifer at 560-610
IM-4	242	208-228	Monitoring well for INJ-3; aquifer at 208-228
IM-5	1204	1140-1160	Monitoring well for INJ-3; sand aquifer above bucatunna clay
IM-6	250	222-242	Monitoring well for INJ-2
INJ-1	4330	3402-3491*	Injection well; plugged and abandoned at 4184
INJ-2	4601	4458-4600*	Injection well
INJ-3	4750	4415-4515*	Injection well

*Perforated zone.

depth of 62.5 feet and 37 feet, respectively. A report by Thompson Engineering Testing, Inc., which includes a description of their installation, log sheets, and locations, is included in Appendix VII. Included in Appendix XII is CDM's Figure A-1, showing typical well construction details of the existing source and area wells, and tables showing coordinate locations, elevations, depths and screened interval of these wells.

5. SAMPLING AND ANALYSIS PROGRAM

As discussed in Section 1.3, the RI was divided into two major subtasks, source characterization and area characterization. The sampling and analysis programs used to characterize the possible sources and areas of contamination as well as the analytical results of these investigations were summarized in Section 1.3.2. The following sections provide a detailed description of the source and area characterization sampling and analysis programs, the results of these investigations, and conclusions regarding the nature and extent of contamination.

5.1 Source Characterization

5.1.1 Landfills

5.1.1.1 Program Description

Soil borings were installed at 45-degree angles beneath the three existing landfills on site and advanced to 50 feet or until ground water was encountered. Composite samples were collected at 10-foot depth increments and analyzed for location-specific compounds as well as priority pollutants and vanadium. A total of twelve soil borings were installed under the three landfills, as shown in Figure 5-1.

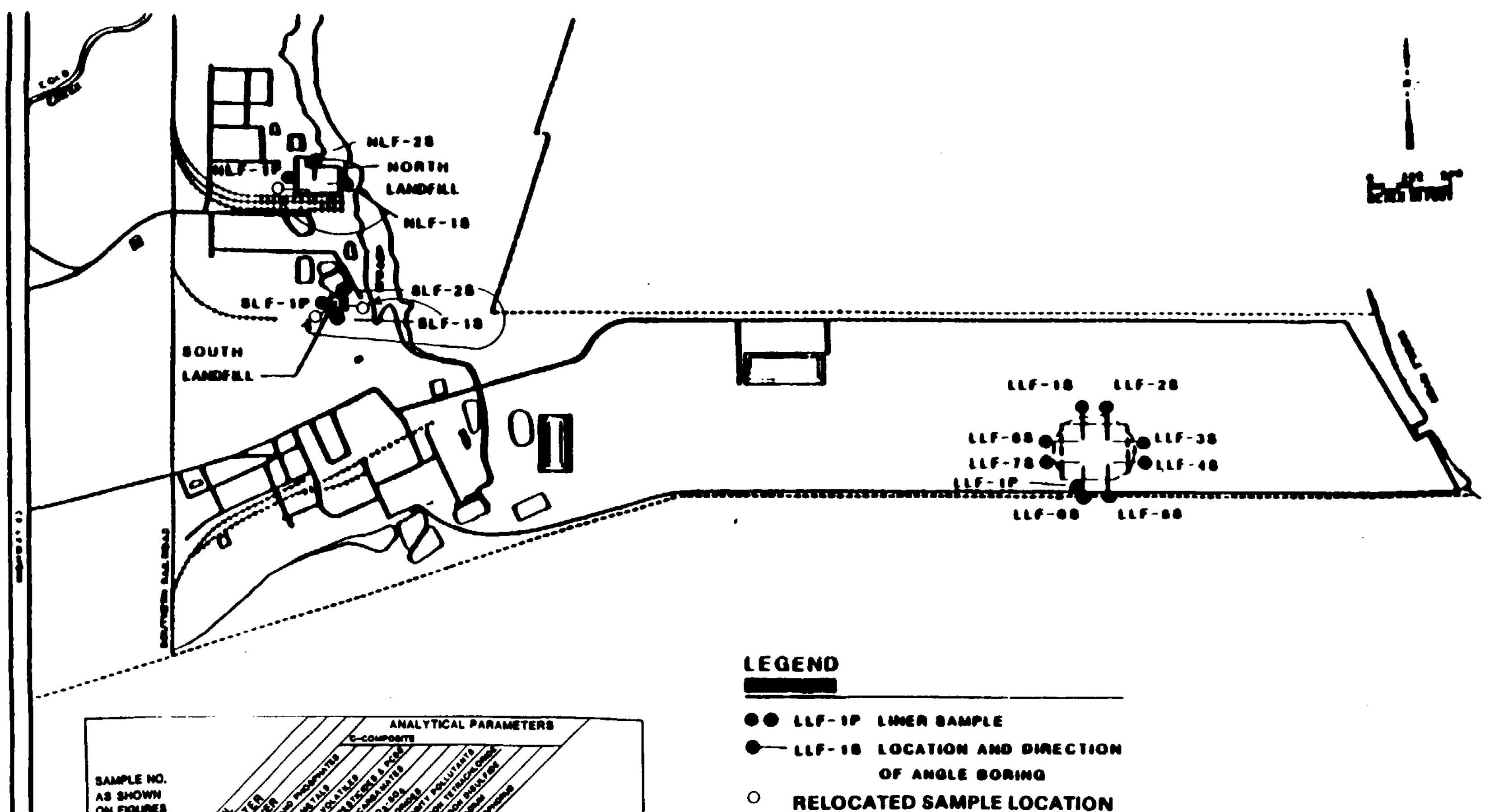
In addition to the soil boring program described above, samples of the DuPont 3110 plastic membrane that lines the top and sides of the three landfills were carefully exposed, sampled, and tested for integrity (see Appendix XVI).

5.1.1.2 Findings and Conclusions

Table 5-1 includes the results of the 12 composite soil samples that were collected from the three landfills and analyzed for priority pollutants and vanadium. Other than

8801043

3 10 00126



SAMPLE NO. AS SHOWN ON FIGURES	SOIL	WATER	COVER	ORGANO PHOSPHATES	P.P. METALS	P.P. VOLATILES	P.P. PESTICIDES & PCBS	THIOCARBAMATES	S-SO3-SO4	CHLORIDES	PRIORITY POLLUTANTS	CARBON TETRACHLORIDE	CARBON DISULFIDE	VANADIUM	PHOSPHORUS	NOTES:
SCC-																North Drumfield (50°045°)
NLF-1S	S			S				S			C			C	S	Boring 1
NLF-2S	S			S			·	S			C			C	S	Boring 2
																South Drumfield (50°045°)
SLF-1S	S							S			C			C	S	Boring 1
SLF-2S	S			S				S			C			C	S	Boring 2
																Lafayne Landfill (50°045°)
LLF-1S	S							C		S	C		S	S	C	Boring 1
LLF-2S	S							C		S	C		S	S	C	Boring 2
LLF-3S	S							C		S	C		S	S	C	Boring 3
LLF-4S	S							C		S	C		S	S	C	Boring 4
LLF-5S	S							C		S	C		S	S	C	Boring 5
LLF-6S	S							C		S	C		S	S	C	Boring 6
LLF-7S	S									S	[illegible]		S	S	C	Boring 7
LLF-8S	S									[illegible]	[illegible]		[illegible]	S	[illegible]	Boring 8

ANALYTICAL PARAMETERS: C–COMPOSITE

(Modified After CDM, 1985)

Figure 5-1 Landfill Sample Locations

TABLE NO. 5-1
COMPOSITE SOIL SAMPLES - LANDFILLS - PRIORITY POLLUTANTS IN Mg/Kg - INCLUDES VANADIUM
(Except for heavy metals, all other priority pollutants are ND)
(See Fig. 5-1 for location)

	NLF-1S	NLF-2S	SLF-1S	SLF-2S	LLF-1S	LLF-2S	LLF-3S	LLF-4S	LLF-5S	LLF-6S	LLF-7S	LLF-8S
Antimony	ND	ND	ND	ND	24	7.5	23	33	16	11	BMDL	8.6
Arsenic	BMDL	1.0	1.0	3	ND	BMDL	ND	BMDL	1.0	BMDL	ND	BMDL
Beryllium	0.17	0.14	0.21	0.65	BMDL	BMDL	0.24	0.055	BMDL	BMDL	ND	BMDL
Chromium	6.5	14	16	31	46	5.3	15	22	7.8	7.1	3.8	5.2
Copper	2.5	2.9	4.5	7.7	48	7.2	23	35	26	19	15	32
Lead	BMDL	BMDL	4	BMDL	6	BMDL	BMDL	ND	BMDL	BMDL	BMDL	BMDL
Mercury	BMDL	0.6	BMDL	BMDL	0.1	BMDL	0.1	ND	BMDL	1.9	0.1	ND
Nickel	1.4	1.6	2.1	3.5	2.8	1.3	3.8	3.9	1.6	4.1	BMDL	1.9
Selenium	ND	BMDL	0.5	0.8	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	8.9	9.6	15	28	12	6.8	19	22	7.1	14	4.4	8.1
Vanadium	8.3	20	26	49	-	-	-	-	-	-	-	-
	--- North ---		---- South ----		Thiocarbamates & phosphorous in all LLF (LeMoyne Landfill)							
	Cold Creek Landfill				---------------------------- Composite samples are ND --------------------							

*Possible False Positive

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

3 10 00127

relatively low levels of heavy metals, which are in the average range for natural soils (see Appendix XVIII), no other priority pollutants were found.

Table 5-2 includes the results of site-specific compound analysis (organophosphates, thiocarbamates, and phosphorous) of soil samples collected from the north and south Cold Creek landfills. With a few minor exceptions, location-specific compound concentrations in the two Cold Creek landfills were not detected or were below the method detection limit (BMDL) for that compound. The highest compound concentration found in the Cold Creek landfills was 1.5 milligrams per kilogram (mg/kg, or parts per million (ppm)) of molinate, a thiocarbamate pesticide which is manufactured at the Cold Creek plant. As shown in Sections 5.1.4 and 5.2.2, thiocarbamates were found at very low levels in many of the source and area wells. However, the mean molinate levels in all wells are below the proposed safe drinking water level of 0.2 mg/l (see Appendix XIX). Based on these findings, the Cold Creek landfills are not considered a significant source of contamination.

Results of the soil samples collected from the LeMoyne landfill are analyzed for chloride, vanadium, and carbon disulfide are included in Table 5-3. Carbon disulfide was not detected in any of the LeMoyne landfill soil samples. One relatively high level, 220 mg/kg, of chloride was detected, and vanadium was found at relatively low levels of from 1.1 to 30 mg/kg. The concentrations of both of these compounds are within the common range of natural soils (see Appendix XVIII). Thus, the LeMoyne landfill is not considered a source of contamination.

The test results of the landfill liner material that was analyzed by Matrecon, Inc. are included in Appendix XVI. Stauffer's materials specialist, Mr. L. Drake, has reviewed these test results and concluded that the membrane covers are still in excellent condition with a high life expectancy.

TABLE NO. 5-2

SOIL SAMPLES - COLD CREEK LANDFILLS - SITE SPECIFIC COMPOUNDS @ 10 FOOT DEPTH INTERVALS - Mg/Kg

(See Fig. 5-1 for location)

	NLF-1S-10'	NLF-1S-20'	NLF-1S-30'	NLF-1S-40'	NLF-1S-50'	NLF-2S-10'
EPTC (Eptam)	BMDL	BMDL	BMDL	BMDL	ND	0.9
Butylate (Sutan)	0.1	0.2	0.1	ND	BMDL	BMDL
Vernolate (Vernam)	BMDL	BMDL	BMDL	ND	ND	0.1
Pebulate (Tillam)	ND	ND	ND	ND	ND	BMDL
Molinate (Ordram)	BMDL	BMDL	0.2	0.9	0.1	1.5
Cycloate (Ro-neet)	BMDL	ND	BMDL	ND	BMDL	0.1
Bensulide (Betasan)	ND	0.5	ND	0.1	ND	ND

NLF-2S-20', SLF-1S-10', SLF-1S-20', SLF-1S-30', SLF-1S-40', SLF-1S-50', SLF-2S-10', & SLF-2S-20' are all ND in site specific compounds except for 0.1 mg/kg Ordram in SLF-2S-20'

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

3 10 00129

TABLE 5-3

SOIL SAMPLES - LEMOYNE LANDFILL - VANADIUM & CHLORIDE IN Mg/Kg @ 10 FOOT DEPTH INTERVALS
(See FIG. 5-1 For location)

	LLF-1S-10'	LLF-1S-20'	LLF-2S-10'	LLF-2S-20'	LLF-3S-10'	LLF-3S-20'	LLF-4S-10'	LLF-4S-20'	LLF-5S-10'	LLF-5S-20'	LLF-5S-30'
Vanadium	14	1.6	30	1.3	9.7	4.8	24	4.9	3.6	3.3	1.9
Chloride	ND	ND	220	ND	ND	ND	ND	ND	ND	ND	57

	LLF-6S-10'	LLF-6S-20'	LLF-6S-30'	LLF-7S-10'	LLF-7S-20'	LLF-7S-30'	LLF-8S-10'	LLF-8S-20'
Vanadium	6.1	5.7	1.8	3.5	1.1	6.2	2.1	4.9
Chloride	ND	ND	57	ND	ND	91	ND	ND

(Carbon disulfide was ND in all LLF samples)

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

3 10 00130

5.1.2 Ponds and Lagoons

5.1.2.1 Program Description

The soil sampling program for the ponds and lagoons was similar to that for the landfills: soil borings were installed at 45-degree angles beneath the nine ponds investigated on site and advanced to 50 feet or until ground water was encountered. Two soil borings were installed under each pond, creating a total of 18 soil borings, as shown in Figure 5-2. Where possible, six samples were collected from each boring. One composite sample was selected for priority pollutant analysis, and the other five were analyzed for compounds specific to the pond.

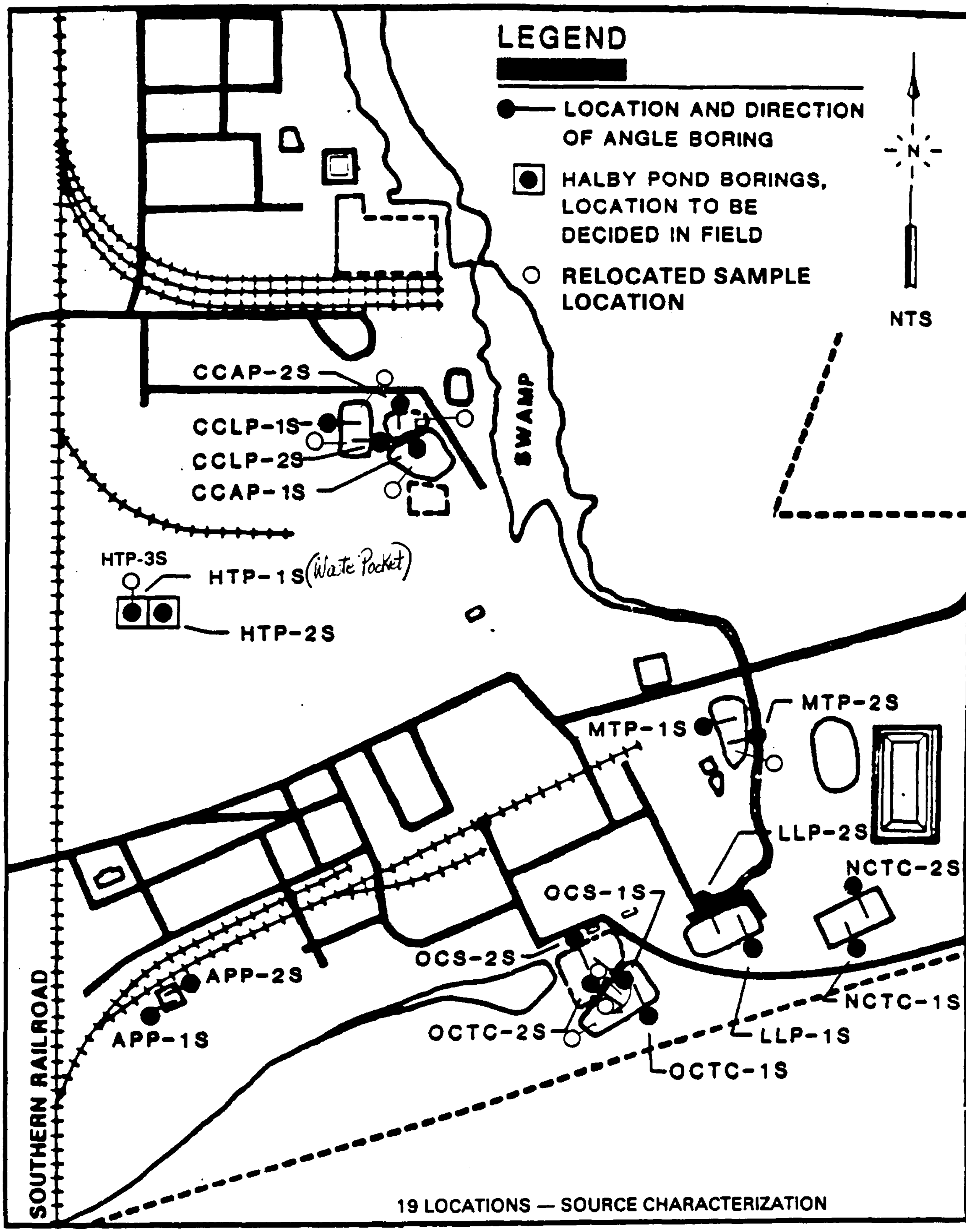
In addition to the soil samples described above, water samples from three active ponds were collected for priority pollutant analysis.

5.1.2.2 Findings and Conclusions

Table 5-4 includes the results of the composite soil samples that were collected from the nine ponds and lagoons and analyzed for priority pollutants. Except for low levels of heavy metals, which are in the average range for natural soils (see Appendix XVIII), the results showed no detectable levels of priority pollutants in any of the composite samples. One exception was sample HTP-1S, taken from the former Halby pond, which showed elevated levels of copper (440 mg/kg), zinc (1170 mg/kg), and cyanide (240 mg/kg). It is thought that this boring encountered a pocket of waste. A second boring within the pond and an angled boring beneath the pond both showed background levels of copper and zinc and no detectable levels of cyanide. Thus, except for a small pocket of waste in the Halby pond, the nine ponds showed no priority pollutant contamination.

Table 5-5 includes the results of composite soil samples from the nine ponds and lagoons that were analyzed for

3 10 00132



(Modified After CDM, 1985)

.Figure 5-2 Pond and Lagoon Soil Sample Locations

8801044

TABLE NO. 5-4
COMPOSITE SOIL SAMPLES - PONDS & LAGOONS - PRIORITY POLLUTANTS IN mg/kg
(Except for heavy metals and some cyanide, all other priority pollutants are ND)
(See Fig. 5-2 for location)

	CCAP-1S	CCAP-2S	CCLP-1S	CCLP-2S	HTP-1S	HTP-2S	HTP-3S	MTP-1S	MTP-2S	NCTC-1S	NCTC-2S	OCTC-1S	OCTC-2S	OCS-1S	OCS-2S	APP-1S	APP-2S	LLP-1S	LLP-2S
Arsenic	2.0	1.0	1.0	2.0	2	1	1	BMDL	BMDL	4.0	BMDL	ND	1.0	7	ND	1.0	2	BMDL	BMDL
Beryllium	0.1	0.12	0.45	0.36	0.11	0.52	0.45	0.04	BMDL	0.13	0.15	BMDL	0.08	0.1	0.11	0.2	0.16	0.08	0.15
Chromium	9.5	7.4	15	16	43	16	14	4.5	8.6	29	100	5.2	15	14	16	12	11	6.5	9.4
Copper	3.8	2.3	5	5.4	442	5.1	4.3	2.3	3.3	4	4.6	18	3.4	15	10	4.2	3.8	2.2	2.7
Lead	ND	BMDL	BMDL	BMDL	22	BMDL	BMDL	4.9	5.8	5.8	BMDL	BMDL	BMDL	BMDL	BMDL	7.2	7.6	5.4	6.1
Mercury	ND	ND	BMDL	BMDL	0.9	BMDL	BMDL	1.4	24	BMDL	BMDL	BMDL	0.3	0.4	BMDL	BMDL	BMDL	BMDL	BMDL
Nickel	1.6	1.6	3.6	3.7	18	6.3	3.3	BMDL	1.6	1.8	8.2	1.2	2.8	2.6	8.4	1.2	1.2	1.7	2.6
Zinc	7.3	5.3	21	15	1170	37	23	9.7	12	15	21	6.1	11	15	20	14	8.4	10	11
Cadmium	ND	ND	ND	ND	1.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Antimony	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.7	31	32	33	ND	ND	ND	ND
Cyanide	1.0*	ND	ND	ND	240	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	---- Cold Creek Ponds ----				--- Halby Pond ---			---------- LeMoyne Ponds ----------											

*Questionable based on QA field blank analysis (see Appendix VI for explanation).

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

3 10 00133

TABLE NO. 5-5 (1 of 2)
SOIL SAMPLES - POND'S & LAGOONS - SITE SPECIFIC COMPOUNDS IN Mg/Kg @ 10 FOOT DEPTH INTERVALS
(See Fig. 5-2 for location)

	CCAP-1S-10'	CCAP-1S-20'	CCAP-1S-30'	CCAP-1S-40'	CCAP-1S-50'	CCAP-2S-10'	CCAP-2S-20'	CCAP-2S-30'	CCAP-2S-40'	CCAP-2S-50'
EPTC (Eptam)	0.3	25	1.2	0.9	ND	ND	1.6	BMDL	0.2	ND
Butylate (Sutan)	0.1	0.3	0.1	0.2	ND	ND	ND	ND	ND	ND
Vernolae (Vernam)	0.1	8.6	0.3	0.3	ND	ND	1.1	0.1	0.1	ND
Pebulate (Tillam)	0.1	1.2	0.2	0.2	ND	ND	0.1	ND	ND	ND
Molinate (Ordram)	0.3	6.4	5	3.7	ND	ND	0.8	0.2	0.2	ND
Cycloate (Ro-neet)	0.2	2.7	0.1	0.5	ND	ND	0.2	ND	ND	ND

-------------------- Cold Creek's old neutralization pond --------------------

	CCLP-1S-10'	CCLP-1S-20'	CCLP-1S-30'	CCLP-1S-40'	CCLP-1S-50'	CCLP-2S-10'	CCLP-2S-20'	CCLP-2S-30'	CCLP-2S-40'	CCLP-2S-50'
EPTC	ND	ND	ND	ND	ND	0.1	BMDL	ND	ND	ND
Butylate	ND	ND	ND	ND	ND	0.1	BMDL	ND	ND	ND
Vernolate	ND	ND	ND	ND	ND	0.1	BMDL	ND	ND	ND
Pebulate	ND	ND	ND	ND	ND	0.1	0.2	ND	ND	ND
Molinate	ND	ND	ND	ND	ND	0.1	0.1	ND	ND	ND
Cycloate	ND	ND	ND	ND	ND	0.2	BMDL	ND	ND	ND

Cold Creek's LeCreek wwt Pond

	HTP-1S-10'	HTP-2S-10'	HTP-2S-20'	HTP-2S-30'	HTP-2S-40'	HTP-3S-10'	HTP-3S-20'	HTP-3S-30'	HTP-3S-40'
Thiocyanate	1,010	550	640	20	ND	2,480	1,030	420	190

-------------------- Halby Pond --------------------

Old Chlorine plant wwt pond

	MTP-1S-10'	MTP-1S-20'	MTP-1S-30'	MTP-2S-10'	MTP-2S-20'
Chloride	650	1,200	680	ND	ND

	NCTC-1S-10'	NCTC-1S-20'	NCTC-1S-30'	NCTC-1S-40'	NCTC-1S-50'	NCTC-2S-10'	NCTC-2S-20'	NCTC-2S-30'	NCTC-2S-40'	NCTC-2S-50'
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

-------------------- New Carbon tetrachloride wwt pond --------------------

	OCTC-1S-10'	OCTC-1S-20'	OCTC-1S-30'	OCTC-1S-40'	OCTC-1S-50'	OCTC-2S-10'	OCTC-2S-20'	OCS-1S-10'	OCS-1S-20'	OCS-1S-30'
Carbon Disulfide	ND	ND	ND	ND	ND	0.016	ND	0.002	ND	0.008
Carbon Tetrachloride	ND	ND	ND	0.001	0.001	ND	ND	ND	ND	ND

Old carbon tetrachloride w wt pond -- - -- Old carbon disulfide w wt pond

3 10 00134

3 10 00135

TABLE NO. 5-5 - continued (2 of 2)

	OCS-1S-40'	OCS-1S-50'	OCS-2S-10'	OCS-2S-20'	OCS-2S-30'	OCS-2S-40'	OCS-2S-50'
Carbon Disulfide	ND	0.003	ND	0.0025	0.005	0.005	ND
Carbon Tetrachloride	0.004	0.003	0.685	0.0066	0.008	0.0035	ND

Acid Plant Pond

	APP-1S-10'	APP-1S-20'	APP-1S-30'	APP-1S-40'	APP-1S-50'	APP-2S-10'	APP-2S-20'	APP-2S-30'	APP-2S-40'	APP-2S-50'
Iron	25,600	4,270	10,100	2,810	1,780	24,500	11,100	4,540	5,780	1,880
Sulfate	ND	ND	ND	210	570	ND	ND	ND	200	580

	LLP-1S-10'	LLP-1S-20'	LLP-1S-30'	LLP-1S-40'	LLP-1S-50'	LLP-2S-10'	LLP-2S-20'	LLP-2S-30'	LLP-2S-40'	LLP-2S-50'
Chloride	ND	ND	ND	65	ND	ND	50	ND	ND	240

LeMoyne LeCreek wwt pond

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

site-specific compounds. Low to moderate (25 mg/kg maximum) levels of a few thiocarbamates were found at the 20-foot depth in the southwest corner of the Cold Creek old neutralization pond. As shown in subsequent sections, the closest downgradient well, CCM-4, showed thiocarbamate levels ranging from below the mean detectable limit to 0.23 mg/l, whereas the next most immediate downgradient wells showed thiocarbamate levels of from below detection limits to 0.01 mg/l. Ultimately, the existing ground-water intercept system is capturing these trace amounts which probably originate from the Cold Creek old neutralization pond.

Discharge of treated water from the intercept wells to the Mobile River is currently governed by the provisions outlined within the existing NPDES permit for the facility. This permit indicates a current limitation or allowance for combined discharge of up to 3.3 lbs/day of thiocarbamates from the facilities. Single-day water analyses recorded monthly since April, 1984 from both the LeMoyne plant and the Cold Creek plant treatment systems indicate that in only one instance (July, 1985 - 4.10 lbs) has this discharge limitation not been met. The majority of the discharge data (see Table 24-1 in Appendix XXIV) indicate less than 1.00 lb/day of thiocarbamate within the discharge stream.

There is little information available regarding the environmental persistence, or fate and transport, of thiocarbamates as they are released to a surface-water body such as the Mobile River. Some information regarding thiocarbamates in general is reported within the Waste Component Characteristics and Behavior section of this report, Section 3.2.

High levels of thiocyanate (2480 mg/kg maximum) were found under the Halby pond, indicating localized contamination around the closed pond, as suggested above. As discussed later, a low level of thiocyanate was detected in ground water downgradient from the Halby pond, whereas no other site-specific compounds were detected. The Halby pond is therefore considered the probable source of thiocyanate contamination found in the ground water.

High iron concentrations (25,600 mg/kg maximum) were found under the LeMoyne acid plant WWT pond. The only finding in the nearest downgradient well, CNA-3, was 0.0003 mg/l CS_2. Because the acid plant pond has never received any CS_2, it is not likely to be a source of CS_2 contamination.

Results of the analysis for priority pollutants of water samples taken from three active ponds are included in Table 5-6. Except for very low levels of a few heavy metals, all the priority pollutants were essentially non detectable.

5.1.3 Swamps

5.1.3.1 Program Description

Three-foot deep soil borings were installed at 34 locations in the Cold Creek Swamp and at four locations in the LeMoyne Swamp, as shown in Figures 5-3 and 5-4, and in Drawing 1.3 in Appendix XVII. A split-spoon sampler, shelby tube, or acrylic tube was used, depending on soil conditions. Excess water was decanted, and the sample was mixed in a stainless steel tray. A subsample was then taken for the composite. Of the 38 composite samples collected, 3 from the Cold Creek Swamp and 4 from the LeMoyne Swamp were analyzed for thiocarbamates, chloride, and priority pollutants. The other 31 samples were analyzed for mercury only.

In addition, fish samples from 5 locations in the Cold Creek Swamp (see Drawing 1.3 in Appendix XVII) were collected and analyzed for mercury in accordance with the Work Plan and subsequent meetings with the EPA. Because of the very small size of the individual fish, an aggregate sample was taken and the analysis was performed on a homogenate, i.e., whole fish.

3 10 00138

TABLE NO. 5-6
POND & SURFACE WATER - PRIORITY POLLUTANTS IN mg/l
(Any priority pollutants not shown are ND or BMDL)

	SW-01-1W	SW-11-1W	CCLP-1W	NCTC-1W	LLP-1W
Carbon Tetrachloride	-	ND	0.0056	0.032	ND
Mercury	0.0002	-	BMLD	0.0003	0.0008
Nickel	ND	-	0.013	BMDL	0.022
Zinc	0.31	-	0.16	0.012	0.023
Cyanide	-	-	ND	ND	0.132
Phenol	ND	ND	ND	0.007	ND
Priority Pollutants Volatiles	-	All ND	-	-	-
	---- Background (Ref. to Fig. 5-5 for location)		(Ref. to Fig. 5-2 for location)		

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

8801045

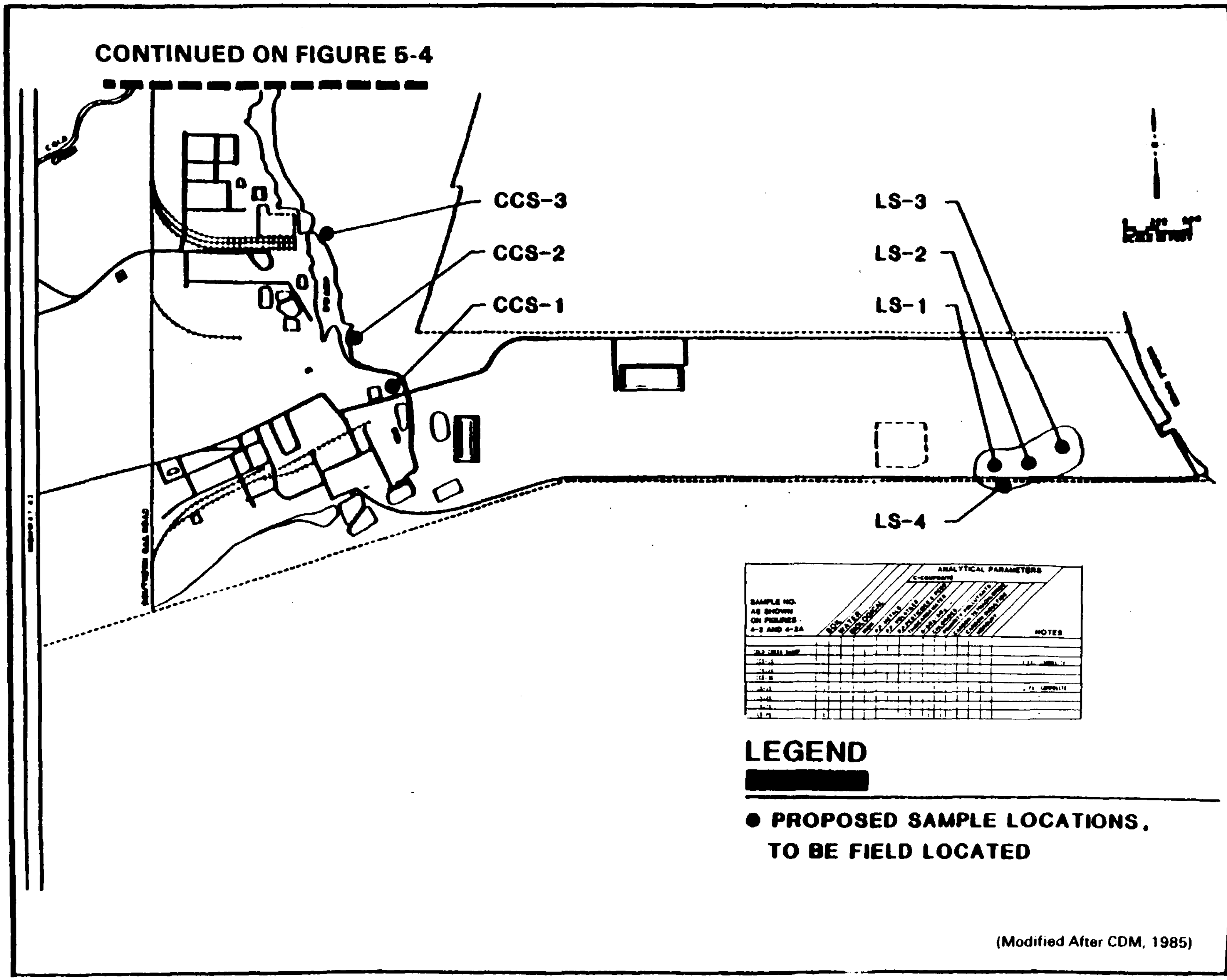


Figure 5-3 Swamp Sample Locations

3 10 00139

3 10 00140

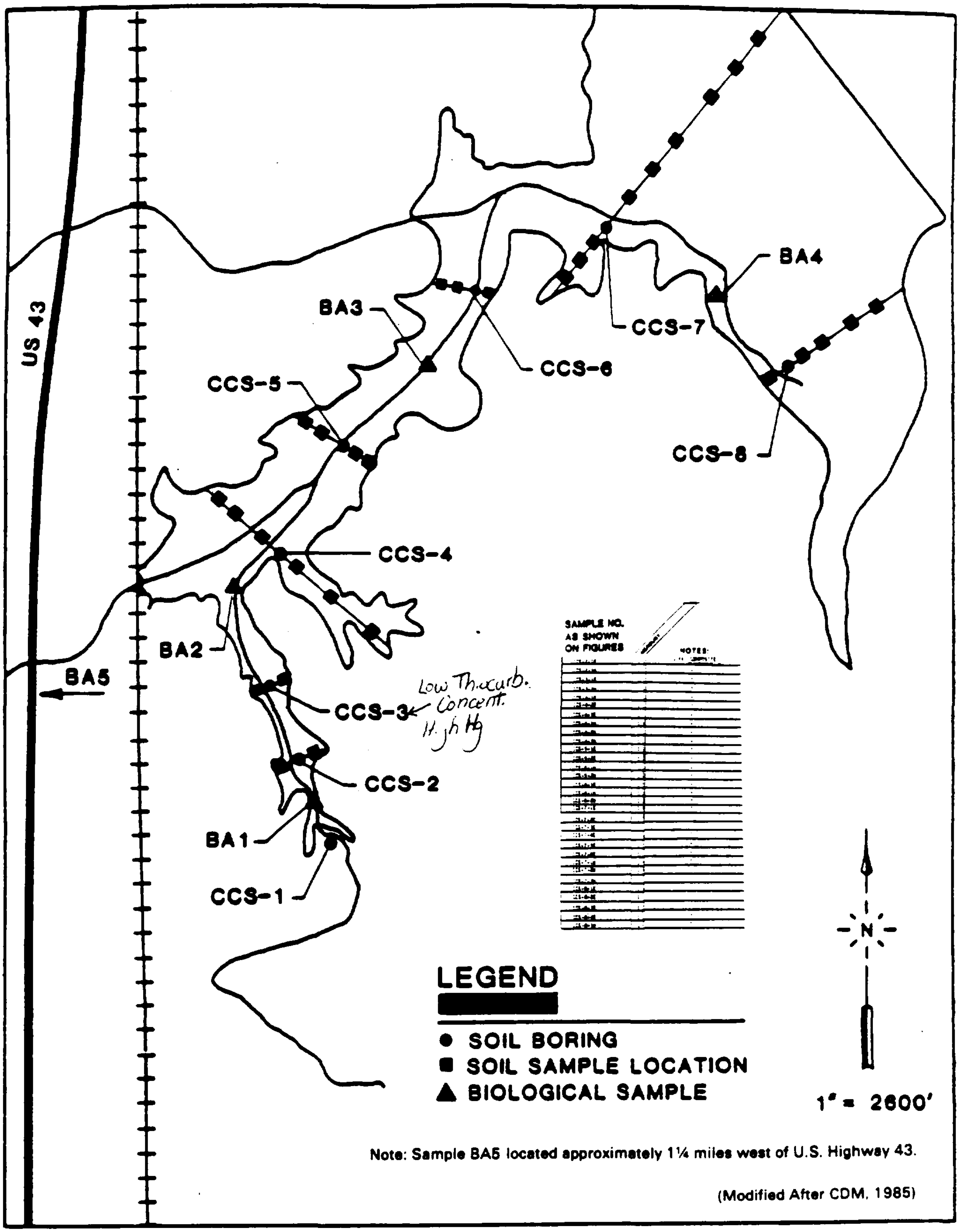


Figure 5-4 Northern Swamp Sample Locations

8801046

5.1.3.2 Findings and Conclusions

Results of the seven swamp samples analyzed for thiocarbamates, chloride, and priority pollutants are included in Tables 5-7 and 5-8.

Among the priority pollutants, only heavy metals with levels typical of natural soils were found. Mercury was the only exception, with a maximum concentration of 300 mg/kg. These heavy metals are insoluble and effectively immobile because the analytical results of ground-water samples, reported later, do not indicate their presence. It is noteworthy that one soil sample, SW-01-1S, selected in the Work Plan as the background level for heavy metals, shows the same relative levels of metals as found in Cold Creek Swamp except for mercury. SW-01-1S was collected near LeMoyne's south property line next to the railroad tracks (see Figure 5-5). It also compares favorably with a road-side sample from U.S. Highway 231 (see ADEMS December 19, 1986 letter in Appendix XV).

Most thiocarbamates were not detected, although a few were present at low levels (1.8 mg/kg maximum). Analysis of downgradient ground water, however, as discussed in subsequent sections, did not detect any thiocarbamates. Therefore, the swamps are not considered sources of thiocarbamate contamination.

Chloride in the Cold Creek Swamp soil samples varied from not detected to 50 mg/kg, and in the LeMoyne Swamp samples from not detected to 190 mg/kg. These levels are within the average range for natural soils; therefore, the two swamps are not considered sources of chloride contamination.

Table 5-9 includes the mercury results of composite soil samples collected from the Cold Creek Swamp. Mercury was found in all but one of the 31 Cold Creek Swamp samples at concentrations of from 0.14 mg/kg to 690 mg/kg. Although the mercury levels are high, the mercury is probably present as the sulfide (as discussed in Appendix XXV) and is therefore immobile and insoluble. This is evidenced by the fact that

TABLE NO. 5-7
COMPOSITE SOIL SAMPLES - COLD CREEK & LEMOYNE SWAMP - PRIORITY POLLUTANTS IN Mg/Kg
(All priority pollutants not shown are ND)

	LS-1S	LS-2S	LS-3S	LS-4S	W-01-1S	CCS-1S	CCS-2S	CCS-3S
Arsenic	ND	ND	2	BMDL	5.0	5	5	5
Beryllium	0.4	0.11	0.71	0.65	0.53	0.46	0.31	0.81
Chromium	19	6.2	24	50	88	130	140	180
Copper	6.4	1.9	10	8.3	68	35	14	34
Lead	15	BMDL	23	12	100	31	BMDL	26
Mercury	0.11	0.15	0.22	0.28	0.9	300	190	230
Nickel	2.1	BMDL	5.8	3.5	5.6	51	32	56
Zinc	12	20	131	55	180	171	312	561
	LeMoyne Swamp				Background Ref. to Fig. D-1 for location	Cold Creek Swamp		

NOTE: Refer to Fig. 5-3, 5-4 and Dwg. No. 1.3 for location of Swamp Samples.

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required.

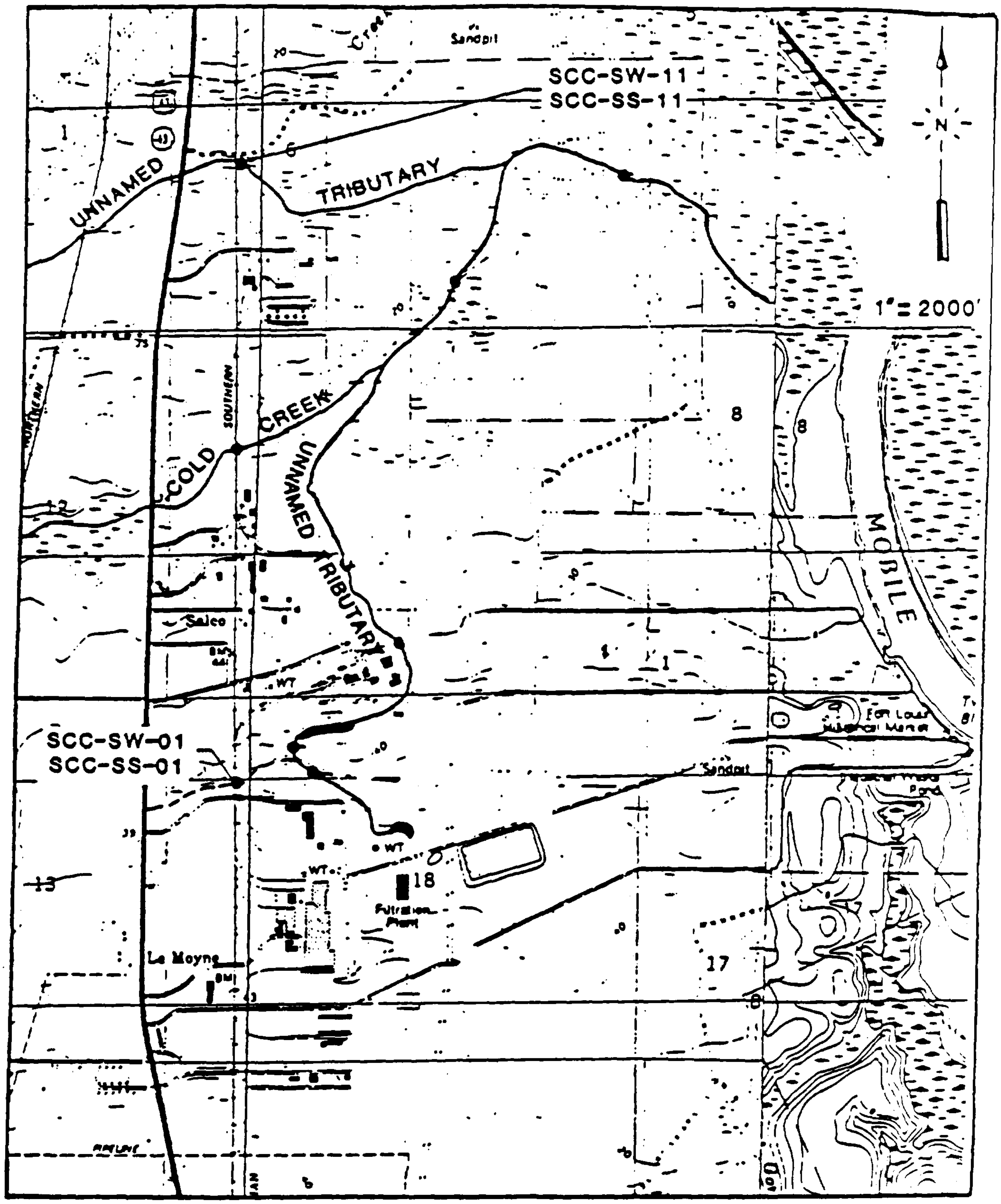
3 10 00143

TABLE NO. 5-8

COMPOSITE SOIL SAMPLES - COLD CREEK & LEMOYNE SWAMP - SITE SPECIFIC COMPOUNDS IN Mg/Kg

	CCS-1S	CCS-2S	CCS-3S	LS-1S	LS-2S	LS-3S	LS-4S
EPTC (Eptam)	0.1	0.2	1.0	ND	ND	ND	ND
Butylate (Sutan)	ND	0.3	1.8	ND	ND	ND	ND
Vernolate (Vernam)	ND	0.2	1.1	ND	ND	ND	ND
Pebulate (Tillam)	ND	ND	0.3	ND	ND	ND	ND
Molinate (Ordram)	0.1	0.4	0.9	ND	ND	ND	ND
Cycloate (Ro-neet)	ND	0.5	1.8	0.2	ND	ND	ND
Chloride	ND	50	50	190	ND	100	50
	------------- Cold Creek ----------			-------------------- LeMoyne --------------------			

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required



(CDM, 1985)

Figure 5-5 Sampling Points on Cold Creek and Tributaries

8801047

3 10 00145

TABLE NO 5-9
COMPOSITE SOIL SAMPLES - COLD CREEK SWAMP - MERCURY IN Mg/Kg (see Dwg. 1.3 for location)

	CCS-2-1E	CCS-2-1W	CCS-3-1W	CCS-3-1E	CCS-4-1E	CCS-4-2E	CCS-4-3E	CCS-4-3W	CCS-4-2W	CCS-4-1W	
Mercury	1.8	7.3	690	29	58	1.2	2.0	BMDL	0.14	15	
	CCS-5-2W	CCS-5-1W	CCS-5-2E	CCS-5-1E	CCS-6-1E	CCS-6-1W	CCS-6-2W	CCS-7-3W	CCS-7-2W	CCS-7-1W	
Mercury	12.7	9.3	5.3	1.8	4.9	6.0	5.6	0.9	22	7.7	
	CCS-7-1E	CCS-7-2E	CCS-7-3E	CCS-7-4E	CCS-7-5E	CCS-7-6E	CCS-8-1W	CCS-8-1E	CCS-8-2E	CCS-8-3E	CCS-8-4E
Mercury	103	35	49	25	10.5	17	2.1	8.3	2.2	1.7	7.0

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

mercury was not detected in downgradient ground water nor in ground water anywhere on the site. Therefore, the Cold Creek Swamp is not considered a source of mercury contamination to ground water.

Results of the analysis for mercury of fish collected from five locations in the Cold Creek Swamp are included in Table 5-10. Mercury levels for four of the sampling locations varied from 0.59 to 3.1 mg/kg of total fish. The background fish sample contained 0.42 mg of mercury/kg of total fish. Whereas the range may exceed the FDA established action level of 0.5 mg/kg for the edible portion of fish tissue, many of the fish were forage fish and unlikely to be eaten. The game fish found at the site were generally juveniles. Some of these may make their way to the Mobile River, and with lower ambient mercury concentrations, body burdens would decline over time because of growth and depuration. Human consumption of fish contaminated from the site, but caught in the river, is considered to be very unlikely. A more detailed discussion of mercury levels in fish, how mercury levels in the swamp may affect other biota, and other potential environmental impacts is included in the Endangerment Assessment, which is being submitted concurrently with this report.

5.1.4 Ground Water

5.1.4.1 Program Description

Two new monitoring wells (NM-1 and NM-2) were installed near the LeMoyne landfill (see Figure 4-2). A report by Thompson Engineering and Testing, Inc., which is included in Appendix VII, gives details on construction of the new wells. These wells and one existing well, CCM-7, were sampled for priority pollutants, thiocarbamates, organophosphates, chlorides, carbon tetrachloride, carbon disulfide and mercury in order to characterize possible source areas of contamination.

In addition, twelve other existing wells, 0-29, 0-31, 0-32, 0-39, 0-41, 0-45, 0-49, 0-58, 0-64, 0-65, 0-73 and CCM-4

TABLE 5-10

FISH SAMPLES - COLD CREEK and LYMOYNE SWAMPS

MERCURY in Mg/Kg TOTAL FISH

	Sampling Location				
	BA-1	BA-2	BA-3	BA-4	BA-5
Mercury Concentration (mg/kg total fish)	0.59	3.1	0.91	1.1	0.42

NOTE: The fish sampling locations are shown on Drawing 1.3 in Appendix XVII.

(see Figure 4-2) were sampled for location-specific compounds for evidence of pond leakage.

5.1.4.2 Findings and Conclusions

The results of the priority pollutant analysis of ground-water samples from the source wells are included in Table 5-11 along with the results for area wells, which are discussed in Section 5.2.2. Table 5-12 includes the results of location-specific compound analysis for the source wells and the area wells.

The priority pollutant and location-specific compound results for wells NM-1, NM-2, and CCM-7 are essentially non detectable except for chlorides, which are in the low to moderate range of from 22.1 to 232 mg/l.

As they have been in the past, high levels of carbon disulfide and carbon tetrachloride were observed in wells 0-29 and 0-31, which are less than 100 feet downgradient of the old carbon tetrachloride and old carbon disulfide/carbon tetrachloride plant wastewater treatment ponds. All other samples from the 12 wells sampled for evidence of pond leakage were low in almost all other compounds. Therefore, except for the old carbon tetrachloride and carbon disulfide/carbon tetrachloride plant wastewater treatment ponds, none of the other ponds on site represent sources of carbon tetrachloride or carbon disulfide contamination.

Carbon tetrachloride was measured in wells 0-39, 0-41, and 0-45 at levels ranging from 0.8 to 1.5 mg/l. These three wells are in the immediate vicinity of the old carbon tetrachloride plant WWT pond mentioned above. The levels of carbon tetrachloride and carbon disulfide in the source and area wells are not considered safe for ingestion by humans or other living organisms. However, because the existing withdrawal and treatment systems preclude access to these ground waters, there is virtually no risk to humans or other organisms. The ground-water intercept system, which has been operating since

3 10 00149

TABLE NO. 5-11

GROUNDWATER - SOURCE & AREA WELLS - PRIORITY POLLUTANTS IN mg/l (Ref. to Fig. 4-2 & 4-3 for location)

(Any priority pollutants not shown are ND or BMDL) Note: Mercury was BMDL in all samples

	SCC-CC-12	SCC-017	SCC-05	SCC-050	SCC-014	SCC-018	SCC-016	CCM-7	NM-1	NM-2	All sample numbers have "-1W" as suffix
Phenol	0.006	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Arsenic	ND	ND	BMDL	ND	ND	0.011	ND	0.03	ND	ND	
Copper	BMDL	ND	ND	0.022	ND	ND	BMDL	ND	ND	ND	
Nickel	0.016	BMDL	BMDL	BMDL	0.014	0.013	BMDL	0.024	0.033	ND	
Zinc	0.063	0.036	0.17	0.052	0.11	0.056	0.1	0.12	0.058	0.022	
Chloroform	-	-	-	-	-	-	-	-	0.051	0.009	

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

TABLE NO. 5-12

GROUNDWATER - SOURCE & AREA WELLS - SITE SPECIFIC COMPOUNDS IN mg/l

Note: Fonofos (Dyfonate), Carbophenothion (Trithion). Phosmet (Imidan) & Bensulide (Betasan) are all ND

(Ref. to Fig. 4-2 & 4-3 for location)

	SCC-05	SCC-08	SCC-014	SCC-016	SCC-017	SCC-018	SCC-22	SCC-23	SCC-24	SCC-25	SCC-50	SCC-51	SCC-52	SCC-78
EPTC (Eptam)	ND	0.001	0.001	0.006	ND	ND	ND	ND	ND	0.001	BMDL	ND	ND	BMDL
Butylate (Sutan)	ND	BMDL	BMDL	0.001	ND	ND	ND	ND	ND	BMDL	BMDL	ND	ND	BMDL
Vernolate (Vernam)	ND	ND	BMDL	BMDL	ND	ND	ND	ND	ND	BMDL	ND	ND	ND	BMDL
Pebulate (Tillam)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND
Molinate (Ordram)	ND	0.002	0.002	0.001	ND	ND	ND	ND	ND	BMDL	BMDL	ND	ND	BMDL
Cycloate (Ro-neet)	ND	BMDL	BMDL	BMDL	ND	ND	ND	ND	ND	BMDL	ND	ND	ND	BMDL
Mercury	ND	-	ND	ND	BMDL	BMDL	ND	ND	ND	-	ND	ND	ND	ND
Carbon Disulfide	ND	ND	BMDL	BMDL	BMDL	BMDL	ND	ND	0.001	ND	ND	ND	ND	0.0002
Carbon Tetrachloride	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND
Thiocyanate	-	-	-	-	-	0.4	-	-	-	ND	-	-	-	-
Chloride	9.7	41.3	16	26.4	4.8	5.3	123.6	37.8	3,900	29.9	45	3.4	3.7	20.9

	CCM-4	CCM-7	NM-1	NM-2	CNA-14	CNA-15	CNA-16	CNA-17	CNAM-1	CNAM-22	CNAM-25	CNAM-28	CNAM-30
EPTC (Eptam)	0.001	0.017	BMDL	BMDL	ND	ND	ND	ND	ND	0.021	ND	ND	0.007
Butylate (Sutan)	0.003	0.013	ND	ND	ND	ND	ND	ND	ND	0.007	ND	ND	0.002
Vernolate (Vernam)	0.004	0.004	ND	ND	BMDL	ND	ND	ND	ND	0.007	ND	ND	0.002
Pebulate (Tillam)	BMDL	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molinate (Ordram)	0.231	0.024	BMDL	ND	ND	ND	ND	ND	ND	0.026	ND	ND	0.026
Cycloate (Ro-neet)	0.004	0.004	ND	ND	ND	ND	ND	ND	ND	0.006	ND	ND	0.001
Mercury	ND	ND	ND	ND	BMDL	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	0.0002	0.0005	ND	ND	0.002	0.005	ND	0.045	0.0007	ND	0.001	ND	0.0006
Carbon Tetrachloride	ND	ND	0.25	ND	-	-	ND	-	0.0176	-	-	0.007	-
Chloride	233	82.6	232	22.1	96.6	11.3	3	4.7	29.4	260	6.2	21.2	53.7

	O-29	O-31	O-32	O-39	O-41	O-45	O-49	O-58	O-64	O-65	O-73
EPTC (Eptam)	0.005	0.005	0.01	0.006	0.005	0.013	0.002	BMDL	0.004	ND	0.005
Butylate (Sutan)	0.002	0.002	0.003	0.002	0.002	0.01	BMDL	ND	0.001	ND	0.001
Vernolate (Vernam)	0.006	0.003	0.002	0.003	0.003	0.009	0.001	ND	0.002	ND	0.002
Pebulate (Tillam)	0.002	BMDL	ND	BMDL	BMDL	0.001	ND	ND	BMDL	ND	BMDL
Molinate (Ordram)	0.009	0.008	0.1	0.009	0.007	0.017	0.004	0.003	0.01	BMDL	0.007
Cycloate(Ro-neet)	0.002	0.002	0.003	0.002	0.002	0.007	BMDL	BMDL	0.002	ND	0.002
Mercury	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND	ND
Carbon Disulfide	22.2	55.6	ND	ND	ND	0.368	ND	ND	0.002	0.002	ND
Carbon Tetrachloride	298	42.4	0.001	0.854	0.812	1.52	ND	0.001	0.001	0.001	0.002
Chloride	390	110.9	35.2	59.8	36.3	130	367	64.2	61.5	169	159

3 10 00150

TABLE 5-12 (cont'd)

	SCC-079	SCC-080	SCCLM-5	SCCLM-6	SCCLM-7	SCCLM-10	SCC-CC-12	CNA-3	CNA-6	CNA-7	CNA-9	CNA-11	CNA-13
EPTC (Eptam)	ND	ND	0.057	0.005	ND	ND	ND	ND	ND	ND	0.002	ND	ND
Butylate (Sutan)	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vernolate (Vernam)	ND	ND	ND	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pebulate (Tillam)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molinate (Ordram)	ND	ND	0.005	0.005	ND	ND	ND	ND	ND	ND	0.003	ND	ND
Cycloate (Ro-neet)	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	BMDL	BMDL	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	0.0008	0.232	ND	ND	ND	0.0003	0.006	ND	ND	0.0005	ND
Carbon Tetrachloride	-	-	-	-	-	-	-		0.0009	0.0145	-	0.0007	-
Thiocyanate	6	ND	-	-	-	-	-	-	-	-	-	-	-

ND, not detected - BMDL, detected below method detection limit - "_" analysis not required

1981, controls ground water in this area. Low levels of these compounds are evident at CNA wells south of the site property line probably because of migration prior to the installation of the intercept system (see Figure 5-7). The CNA system serves to effectively purge the area of any small residual quantities.

5.2 Area Characterization

5.2.1 Surface Water and Soils

5.2.1.1 Program Description

Two surface-water and two soil samples were collected off-site to determine background levels of the compounds of concern. As shown in Figure 5-5, a surface water sample was collected from, and a soil sample was collected adjacent to, two unnamed tributaries to Cold Creek. One tributary is located north of the Virginia Chemicals plant, which is north of Cold Creek, and the other is located approximately 100 feet north of the LeMoyne-CNA property line near the railroad tracks. As outlined in CDM's Work Plan, the soil and surface-water samples from the northern tributary were analyzed for priority pollutant volatile organic compounds, and the soil and surface-water samples from the southern tributary were analyzed for priority pollutant metals.

5.2.1.2 Findings and Conclusions

The results of the background surface-water and soil sample analyses are included in Appendix II and summarized in Tables 5-6 and 5-7. No priority pollutant volatile organic compounds were detected in the background soil or surface-water samples. Several heavy metals were found in the background soil sample taken near the railroad tracks. With the exception of mercury, however, all metals were found at levels within the common range for natural soils (see Appendix XVIII). These results indicate that background mercury levels are higher than those in natural soils. Very low levels of mercury (0.0002 ppm) were found in the background surface-water sample analyzed for metals. The only other metal found was zinc, at a concentration of 0.31 ppm.

5.2.2 Ground Water

5.2.2.1 Program Description

In order to characterize the area ground water, 36 wells (one well, CNA-8, was inoperative) were sampled in addition to those mentioned in Section 5.1.4 above (see Figure 4-3). Seven of these well samples, SCC-05, SCC-014, SCC-016, SCC-017, SCC-018, SCC-050, and SCC-CC12, were analyzed for priority pollutants. The remaining well samples were sampled for location-specific compounds.

5.2.2.2 Findings and Conclusions

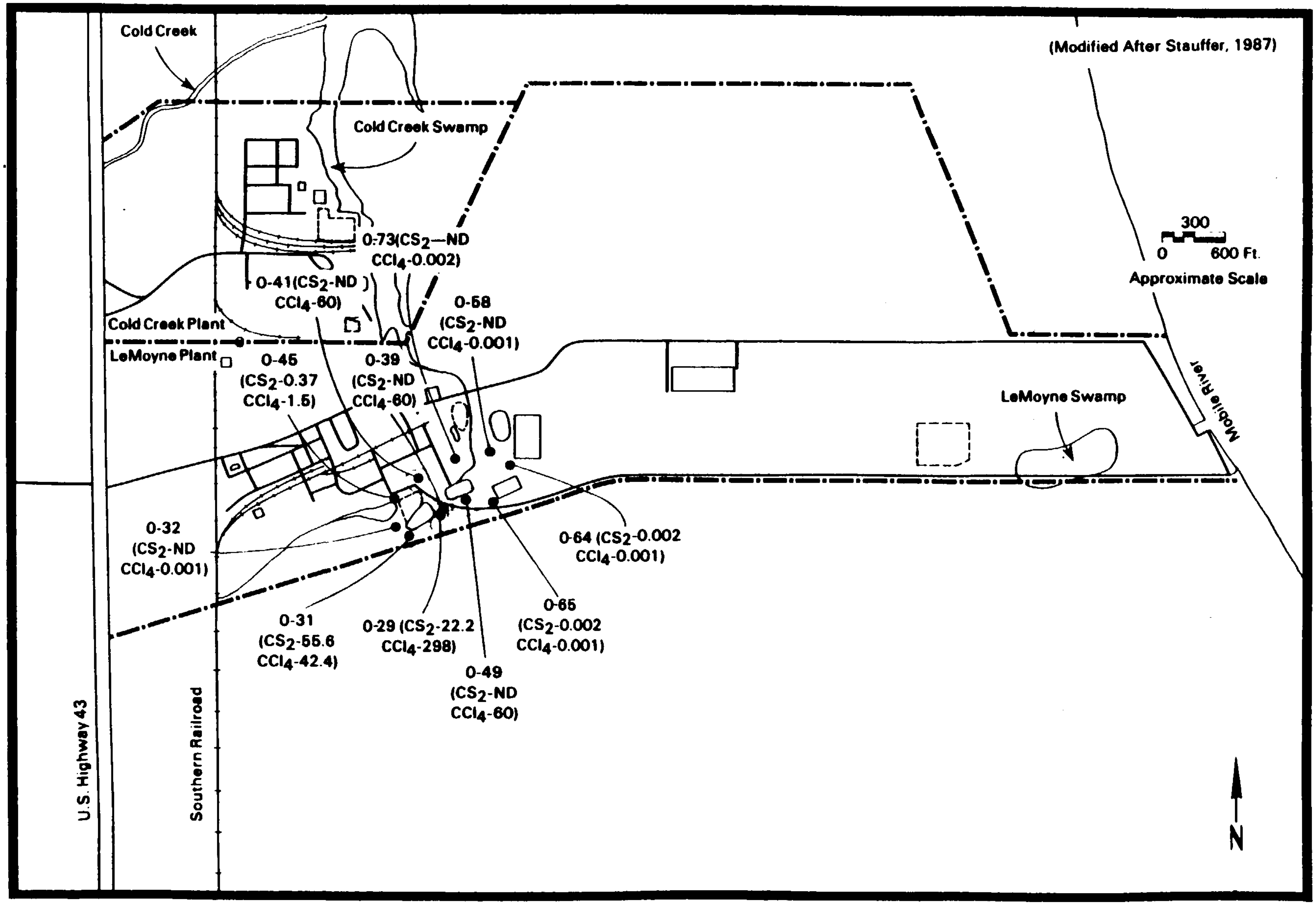
Table 5-11 includes the results of priority pollutant analysis of ground-water samples from area and source wells. As shown, no priority pollutants were detected except for low concentrations of heavy metals (0.01 to 0.17 mg/l).

The results of location-specific analysis, included in Table 5-12, show non-detectable to very low levels of almost all compounds. The two exceptions are 6 mg/l thiocyanate in SCC-079 and 0.23 mg/l carbon disulfide in SCC-LM6. SCC-079 is just downgradient of the closed Halby pond.

Chloride levels are low (3.4 to 123.6 mg/l) with the exception of well SCC-24, which is immediately adjacent to the salt barge unloading area at the Mobile River. Here, the chloride level of 3,900 mg/l is a highly localized condition attributed to the on-going surface handling of large volumes of rock salt.

These results clearly demonstrate that the heavy metals found in swamp soil samples are insoluble and immobile and have no effect on downgradient ground water.

Figure 5-6, carbon tetrachloride/carbon disulfide in LeMoyne source wells, and Figure 5-7, carbon tetrachloride/carbon disulfide in area wells downgradient from LeMoyne, are firm evidence of the effectiveness of Stauffer's existing interceptor well system. As concentrations of contaminants at the interceptor wells decrease (see Figure 1-12 for history since installation), the already low concentrations (less than 0.05 mg/l) of contaminants downgradient should eventually fall below detectable limits.

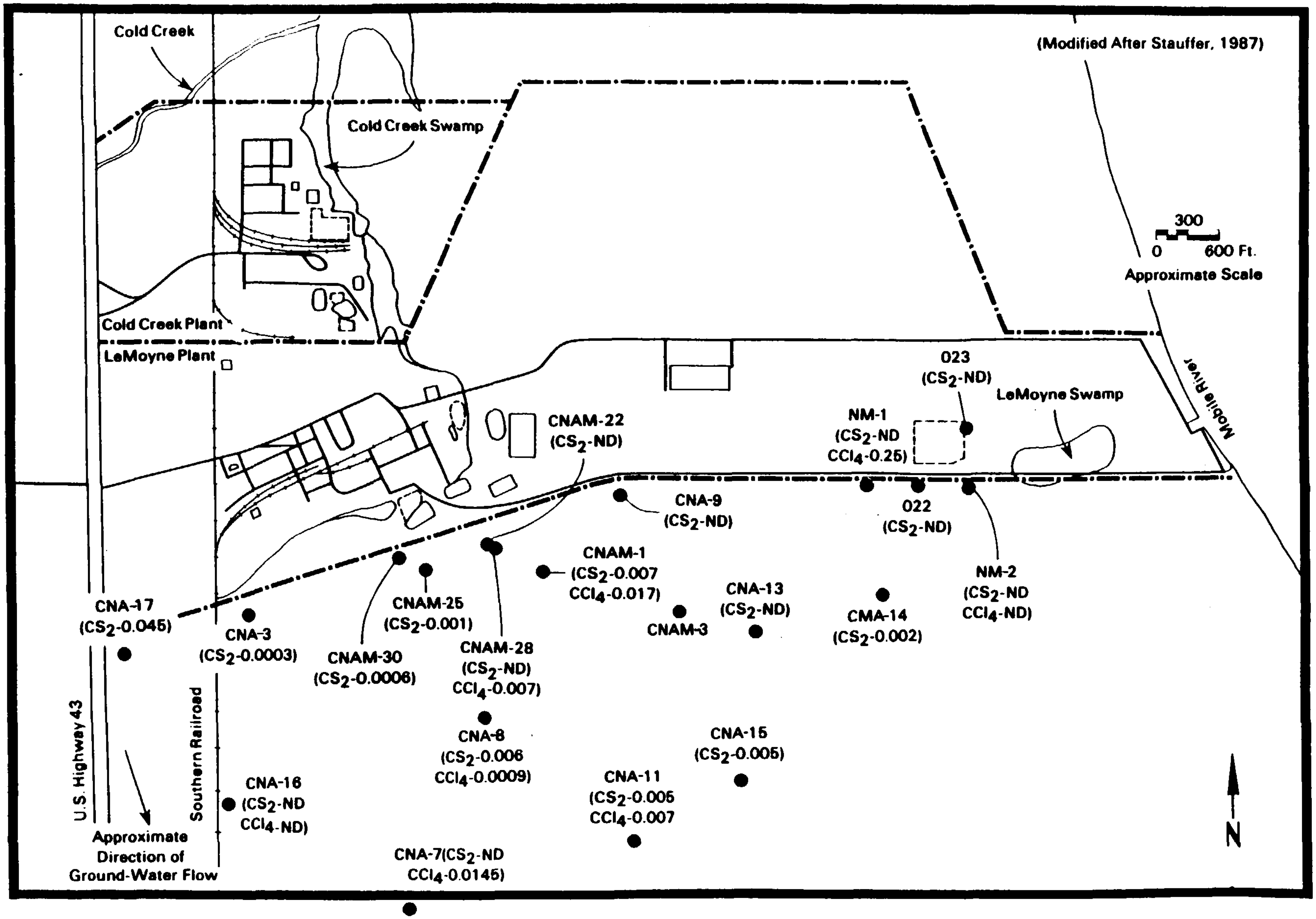


Note: CS_2 And CCl_4 Concentrations Are In MG/L Or PPM

Figure 5-6 Carbon Tetrachloride and Carbon Disulfide Concentrations in LeMoyne Source Wells

8801049

3 10 00156



Note: CS_2 And CCl_4 Concentrations
Are In MG/L Or PPM

Figure 5-7 Carbon Tetrachloride and Carbon Disulfide Concentrations in Area Wells Downgradient from LeMoyne

6. PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS

An Endangerment Assessment has been prepared for the Cold Creek/LeMoyne site by ERT (ERT, 1988). A summary of this work is presented in this section. The following discussion is divided into three parts: potential receptors, public health impacts, and environmental impacts. The first part identifies human and environmental (flora and fauna) receptors that are or may be exposed to site contamination, and the second and third parts discuss the impacts of site contaminants on human and environmental populations.

The purpose of an endangerment assessment is to determine if endangerment to human health or the environment exists as a result of a threatened or actual release of a hazardous substance (EPA, 1985). Usually, the endangerment assessment is the interpretive link between the remedial investigation and the feasibility study, and it is used to determine whether a remedial action is necessary and how quickly steps must be taken to protect potentially affected populations or environments.

6.1 Potential Receptors

As discussed previously in Section 1.2, the Cold Creek/LeMoyne site is located in an industrial area and is surrounded by several other large chemical production companies. Fewer than 10 residences are located within one mile of the site, and none of them are downgradient of the contaminated ground water at the site. The nearest population centers include Mt. Vernon (with a population of 1,038), which is located about 8 miles north of the site, and Creola (population of 673), which is located about 5 miles to the south (U.S. Department of Commerce, 1981).

The majority of the chemical plants as well as the local communities in the area obtain water from the water-table aquifer. As discussed earlier in Section 1.2, and shown in

Figure 1-2, the Cold Creek facility has one drinking-water well and one backup well, and the LeMoyne facility has two drinking-water wells. The CNA facility to the south has one drinking-water well and a backup well. These wells were sampled during the RI, and no contaminants were detected.

Both Cold Creek Swamp and LeMoyne Swamp represent the most important environmental receptors at the site. These swamps currently support a diverse variety of plants and animals, including the alligator, which is currently listed as a threatened species. The Mobile River, which forms the eastern boundary of the site, is also a potential environmental receptor.

6.2 Public Health Impacts

To properly assess the potential public health impacts from the Cold Creek/LeMoyne site, a characterization of the potential areas of contamination must be made. These include the nine ponds or lagoons, four of which are still active, the three closed landfills, and portions of the two swamps (Cold Creek and LeMoyne). Figure ES-1 shows the locations of these 14 potential source areas.

Based on the frequency of detection, the concentrations detected, and the toxicological properties of the contaminants which have been found at the site, the following compounds were selected as "representative" compounds. These are:

- carbon tetrachloride;
- carbon disulfide;
- cyanide;
- mercury;
- 6 thiocarbamates (including EPTC, butylate, cycloate, molinate, pebulate, and vernolate); and
- thiocyanate.

Information concerning safe drinking water levels for many of these contaminants is presented in Appendix XIX. In addition, available toxicity information for aquatic species is included in these reviews.

After identifying the potential receptors and the contaminants to which they may be exposed, it is necessary to determine the ways in which they may be exposed and the frequency and magnitude of the potential exposure. Human exposure to the contaminants identified at the Cold Creek/LeMoyne site can potentially occur directly through air, water or solid media (soils, sediments or sludges) or indirectly through the food chain; however, the most likely exposure pathways are as follows:

- Incidental ingestion of contaminated swamp sediments;
- dermal contact with contaminated swamp sediments;
- ingestion of contaminated fish; and,
- ingestion of contaminated ground water.

Exposure to contaminated swamp sediments and via ingestion of fish is probably infrequent because the site is located in an industrial area and people generally do not spend much time in wetland areas unless they are bird watchers or are on other kinds of nature walks. In addition, shoes and other articles of clothing will help to protect anyone from direct contact with the swamp sediments. Ingestion of contaminated fish is also expected to be infrequent because it is unlikely that anyone fishes in Cold Creek Swamp, given its proximity to industrial property, its restricted access, and the small size of the fish in the swamp.

No current risk appears to exist from exposure to contaminated ground water at the site, because none of the contaminants have been detected in any of the drinking-water wells in the immediate vicinity of the site. It is highly unlikely that future exposure to contaminated ground water would occur, because a permit is required for the installation of a potable water well from the state of Alabama, and it is unlikely that a permit would be granted given the documented ground-water contamination at the site.

One way of assessing the risks is to quantify the potential for adverse health effects due to site-related chemical exposure. As described in more detail in the Endangerment Assessment (ERT, 1988), noncarcinogenic effects are assumed to have a threshold dose below which an adverse health effect will not occur. In order to determine the risks, the estimated intakes of indicator chemicals that may lead to noncarcinogenic effects are compared to acceptable daily intakes. This ratio is called the hazard index (HI). An HI of less than one (unity) results when estimated intake is less than acceptable intake, which indicates that levels of intake are lower than those expected to produce toxic effects.

As shown in Table 6-1, quantitative risk estimates were conducted for both adult workers and teenagers that could be exposed to contaminants at the Cold Creek/LeMoyne site. Using conservative assumptions, risks were calculated for hypothetical individuals who may come in contact with hazardous compounds via exposure to contaminated swamp sediments and ingestion of contaminated fish. Two scenarios were developed for each exposure route. The worst-case scenario assumes that an individual is exposed to the maximum concentration of the compound measured in that media (i.e., sediments or fish), and the realistic case uses average concentrations found at the site. For teenagers, it was assumed that they would be exposed to contaminated swamp sediments 6 times per year for a period of 5 years, and for adult workers it was assumed that they be exposed 12 times per year (once a month) for 30 years. In determining risk from ingestion of contaminated fish, it was assumed that an individual would consume 6.5 grams of fish per day for a period of 30 years.

Results of the quantitative risk assessment for noncarcinogens show that individuals exposed to contaminants at the Cold Creek/LeMoyne site are not at risk, even if they are exposed to maximum concentrations. Even when the risks for

TABLE 6-1 SUMMARY OF QUANTITATIVE RISK ESTIMATES FOR EXPOSURE TO CONTAMINANTS AT THE COLD CREEK/ LEMOYNE SITE, MOBILE COUNTY, ALABAMA.

Chronic Hazard Index (noncarcinogens) for Adult Workers at the Cold Creek/LeMoyne Sites

Compound	Acceptable Chronic Daily Intake (mg/kg/day)	Ingestion of Swamp Sediments Worst Case	Ingestion of Swamp Sediments Realistic Case	Dermal Absorption of Swamp Sediments Worst Case	Dermal Absorption of Swamp Sediments Realistic Case	Fish Consumption Worst Case	Fish Consumption Realistic Case	Total Hazard Index Worst Case	Total Hazard Index Realistic Case
Carbon Tetrachloride									
Carbon Disulfide	1.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00
Cyanide	2.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00
Mercury	2.00E-03	6.95E-03	4.60E-04	0.00E+00	0.00E+00	6.15E-02	2.45E-02	6.85E-02	2.50E-02
Thiocarbamates:									
EPTC	5.00E-02	4.02E-07	7.18E-08	1.01E-08	1.80E-09			4.12E-07	7.36E-08
Butylate	5.00E-01	7.24E-08	1.21E-08	1.81E-09	3.02E-10			7.42E-08	1.24E-08
Vernolate	3.20E-02	6.91E-07	1.17E-07	1.73E-08	2.92E-09			7.08E-07	1.20E-07
Pebulate	1.60E-02	3.77E-07	5.40E-08	9.44E-09	1.33E-09			3.87E-07	5.54E-08
Molinate	7.20E-02	2.51E-07	5.39E-08	6.29E-09	1.35E-09			2.58E-07	5.52E-08
Cycloate	5.00E-03	7.24E-06	1.44E-06	1.81E-07	3.60E-08			7.42E-06	1.47E-06
Thiocyanate									
Total:		6.96E-03	4.62E-04	2.26E-07	4.37E-08	6.15E-02	2.45E-02	6.85E-02	2.50E-02

Chronic Hazard Index (noncarcinogens) for Teenagers at the Cold Creek/LeMoyne Site

Compound	Acceptable Chronic Daily Intake (mg/kg/day)	Incidental Ingestion of Swamp Sediments Worst Case	Incidental Ingestion of Swamp Sediments Realistic Case	Dermal Absorption of Swamp Sediments Worst Case	Dermal Absorption of Swamp Sediments Realistic Case	Total Hazard Index Worst Case	Total Hazard Index Realistic Case
Carbon Tetrachloride							
Carbon Disulfide	1.00E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0.00E+00
Cyanide	2.00E-02						
Mercury	2.00E-03	8.10E-04	5.35E-05	0.00E+00	0.00E+00	8.10E-04	5.35E-05
Thiocarbamates:							
EPTC	5.00E-02	4.70E-08	8.38E-09	1.90E-09	3.44E-10	4.89E-08	8.72E-09
Butylate	5.00E-01	8.46E-09	1.41E-09	3.42E-10	5.70E-11	8.80E-09	1.47E-09
Vernolate	3.20E-02	8.06E-08	1.36E-08	3.26E-09	5.53E-10	8.39E-08	1.42E-08
Pebulate	1.60E-02	4.41E-08	6.31E-09	1.78E-09	2.55E-10	4.58E-08	6.57E-09
Molinate	7.20E-02	2.93E-08	6.29E-09	1.19E-09	2.54E-10	3.05E-08	6.55E-09
Cycloate	5.00E-03	8.46E-07	1.68E-07	3.42E-08	6.80E-09	8.80E-07	1.75E-07
Thiocyanate							
Total:		8.11E-04	5.37E-05	4.27E-08	8.26E-09	8.11E-04	5.37E-05

3 10 00161

each exposure route and each compound are summed, the total HI is still less than unity. However, care must be taken when interpreting summed HI's, because adding them assumes that their toxicological effects are additive, which may not be true.

The underlying assumption for assessing the risks from suspect or known human carcinogens is that there is no threshold for an adverse health effect. Carcinogenic risk is quantified by multiplying an EPA-derived cancer potency factor by the estimated intake (dose) to calculate cancer risk due to each site-related exposure. Carbon tetrachloride is the only indicator compound at the Cold Creek/LeMoyne site which is considered by the EPA to be a suspect human carcinogen. This compound was only detected in the ground water and in subsurface soil samples from beneath the wastewater treatment ponds. As discussed above, there is no current risk from exposure to contaminated ground water, and therefore, there is no current risk from carbon tetrachloride at this site.

6.3 Environmental Impacts

The most environmentally sensitive portion of the site is believed to be the Cold Creek Swamp. Sediment concentrations and fish body burdens of mercury are both elevated in this area. Potential exposure routes for aquatic and semi-aquatic organisms include water, sediment and food chain pathways, with the food chain exposure route predominating at higher trophic levels. The U.S. Fish and Wildlife Service (USFWS) considers the swamp to be a preferred habitat for the threatened American alligator (Alligator mississippiensis), and the potentially endangered Alabama Red-Bellied turtle (Pseudemys alabamensis).

Current data are not adequate to assess the exposed biota populations or estimate exposure via all pathways and thus to estimate potential risks to these populations. With the data at hand, the potential for adverse affects to sensitive birds and mammals, if these inhabit the wetland, cannot be ruled out.

7. DETERMINATION OF APPLICABLE REMEDIAL ACTION ALTERNATIVES

7.1 Description of Remedial Alternatives Screening Process

The principal objectives for any Remedial Investigation (RI) are to provide to the greatest extent possible a complete environmental characterization of the site and to determine the extent and type of environmental contamination which has occurred as a result of previous site activities. Information obtained during the RI is used to determine whether environmental contamination is confined to the site/source area, or whether an off-site release of contamination has occurred. The acquired information is used in the Feasibility Study (FS) process, the purpose of which is to identify these remedial technologies or combinations of remedial technologies (i.e., remedial alternatives) which are considered most cost-effective, technically feasible and reliable, and which adequately protect (or mitigate damage to) public health, welfare and the environment.

The Feasibility Study for the Cold Creek/LeMoyne site will be structured to follow as closely as possible the guidelines established by the EPA as documented in Guidance on Feasibility Studies Under CERCLA (June, 1985), and the new requirements of the Superfund Amendments and Reauthorization Act of 1986. A brief discussion of the Feasibility Study process follows.

The Feasibility Study will involve three steps: the development of remedial response objectives for the site; identification and initial screening of applicable remedial technologies and development of alternatives; and screening of remedial technologies and/or alternatives ultimately leading to recommendation of a proposed remediation program which is considered best suited for the site.

The remedial response objectives will be developed based on the findings of the RI and the site risk assessment. This step generally involves the identification of those areas or portions of the site which require remediation and a determination of the extent of remediation to be attained.

The legally applicable or relevent and appropriate requirements (ARARs) of federal and state laws will represent institutional objectives for clean up of the site and form the basis for remediation goals. If there are no ARARs associated with a specific compound or medium, a health risk evaluation will provide the basis for remediation goals.

Based on the remediation goals developed for the Cold Creek/LeMoyne site, potential response actions will be identified for each area that may require remediation. The technology options associated with each general response action will be specified. In accordance with SARA, these options will include technologies that would provide a permanent solution and alternative treatment or resource recovery technologies. The identified technologies will be screened so that those technologies that are not applicable to site conditions or not technically feasible will be eliminated from further consideration.

Those technologies remaining after the preliminary screening will be used to develop remedial alternatives that are effective and technically feasible for the site.

In accordance with the Interim Guidance on Superfund Selection of Remedy (U.S. EPA, 1986), treatment alternatives will be developed that range from "an alternative that, to the degree possible, would eliminate the need for long term management (including monitoring) at the site to alternatives involving treatment that would reduce toxicity, mobility, or volume as their principal element. In addition to the range of treatment alternatives, a containment option involving little or no treatment and a no action alternative..." will be developed.

The potential alternatives will be screened in two phases to determine which should be retained for a detailed evaluation. First, environmental and public health effects of each alternative will be evaluated. Those alternatives that would have adverse environmental or public health impacts will be eliminated from further consideration. The second phase will consist of an order of magnitude cost screening. The alternatives remaining after the initial screening will be grouped according to the level of public health and environmental protection and reliability associated with each. In accordance with SARA, a cost comparison will not be conducted between treatment and nontreatment alternatives. Those alternatives within each group which provide a commensurate level of protection, yet have costs an order of magnitude greater than the other alternatives in the same group, will be eliminated from further consideration.

Those alternatives remaining after the initial screening will undergo a detailed evaluation based on both non-cost and cost criteria. The non-cost evaluation will begin with an assessment of each alternative's feasibility and overall effectiveness. Other non-cost criteria will include: the criteria for selection of remedy in SARA § 121 (d); environmental and public health impacts; and the interplay between remedial technologies applied to different portions of the site.

The cost evaluation will involve a comparative analysis of the alternatives on the basis of present-worth costs for both capital expenditures, and operation and maintenance expenditures. In accordance with the current EPA costing guidance, the costs will be estimated within an accuracy range of -30 to +50 percent. While this range may appear large compared to typical construction estimates, there are many uncertainties and complexities associated with work involving the cleanup of hazardous wastes. As described for the initial screening evaluations, the cost comparison will be conducted between treatment alternatives only.

To summarize the data compiled during the detailed evaluation, pertinent information involving both cost and non-cost criteria will be presented in tabular form. This will facilitate the overall evaluation and selection process by presenting the key differences between each of the alternatives in a clear and concise manner.

The Feasibility Study will conclude with recommendations for remedial action based upon the results of the detailed analysis of alternatives.

7.2 Remedial Alternatives Selected for Consideration

The Remedial Investigation of the Cold Creek/LeMoyne site has identified the areas on site which are considered as potential contaminant source areas requiring some form of remediation. These areas include the former Halby pond (Area I), the old carbon tetrachloride (CTC) plant wastewater treatment pond (Area II), the old carbon disulfide plant wastewater treatment pond (Area III), and the Cold Creek old neutralization pond (Area IV). Each of these areas presents a specific set of circumstances with regard to the type and extent of environmental contamination and the requirements for suitable remedial action.

The general response measures identified below are based on site conditions, information obtained during the Remedial Investigation, and the risk assessment. The following potential general response measures are identified:

- No Action - A no-action response provides a baseline assessment for comparison with other alternatives that contain greater levels of response. An alternative involving no action may be considered appropriate when an alternative response action may cause a greater environmental or health danger than the no-action alternative itself. An evaluation of the no-action response is required as part of the feasibility study process. In some cases, the no-action response may include some limited form of action, such as periodic sampling and analysis.

- <u>Containment</u> - Containment measures include various technologies which contain and/or isolate the constituents of concern on site. These measures provide isolation and prevent direct exposure with or migration of contaminated media without disturbing or removing the waste from the site. Containment measures generally consist of measures which cover, seal, chemically stabilize or provide an effective barrier against specific areas of contamination.

- <u>Withdrawal/Collection</u> - Collection of contaminated ground-water may be achieved via withdrawal techniques such as pumping or gravity drainage. Water treatment may be required in conjunction with withdrawal/collection actions to reduce contaminant levels in the extracted liquid, thereby allowing its discharge. Treatment techniques include chemical, biological, or physical removal systems. The existing extraction and treatment system will be evaluated and modifications proposed if appropriate.

- <u>Removal</u> - Removal measures may be undertaken to remove contaminated media such as soils from the site. Implementation of a removal measure requires proper treatment and/or disposal of the soil, either on site or at an approved off-site waste disposal facility. Replacement of the media to restore the site is necessary with a removal action. Removal measures may be used to effectively remove the contaminated media from the site; however, a significant short term exposure hazard during remedial action implementation will occur.

- Treatment - Various in-situ, or in-place, treatment methods will be considered which are effective in detoxifying the waste material without having to excavate it or remove it from the site.

Each of the general response measures will be considered for each of the individual areas of concern during the Feasibility Study. Technologies applicable to each response measure will be identified and screened as previously discussed. Remedial alternatives for the entire site will be developed from these technologies and evaluated. The remedial alternative recommended at the conclusion of the Feasibility Study will contain components which address each individual area of concern.

8. SUMMARY

As discussed in Section 1 of this report, the objectives of this Remedial Investigation were to characterize the nature and extent of contamination at the site and to identify contamination sources, pathways of migration, and potential adverse environmental impacts. In order to accomplish these objectives, a substantial amount of data pertaining to the site-area geology, hydrogeology, surface-water drainage as well as soil, surface-water, and ground-water quality has been collected and evaluated. The findings of the RI are summarized as follows.

Fourteen potential contaminant source areas on the site were investigated during the RI. These potential sources were initially identified in CDM's Work Plan and include the nine ponds or lagoons, four of which are active, three closed landfills, and the Cold Creek and LeMoyne Swamps (see Figure ES-1 for locations). A summary of the information presented in Section 5, which is a description of the sampling and analysis program, is included in Table 8-1. This table shows the major contaminants found in soil samples collected from beneath each potential source, the range of concentrations (minimum to maximum) of each major contaminant, and the levels of any contaminants in the nearest downgradient well samples. Based on the results presented in Section 5 and in Table 8-1, a summary of the findings and conclusions regarding the nature and extent of contamination at each of the potential source areas is presented as follows.

1. LeMoyne Landfill - Only background levels of heavy metals were found in any of the soil samples collected form the 8 borings installed beneath the LeMoyne landfill. The median level of the hazardous contaminant found (mercury) was less than 0.1 mg/kg, which is within the common range for natural soils and less than the level of mercury found in the

3 10 00170

TABLE 8-1

POTENTIAL AREAS OF SOURCE CONTAMINATION AND DOWN GRADIENT GROUND WATER DATA

Area	Potential Major Contaminant(s)*	Range mg/kg	Contaminants in Nearest Down Gradient Ground Water mg/l	Well Number
1. LeMoyne landfill	Mercury	ND to 1.9	0.25 Carbon Tetrachloride	NM-1
2. Cold Creek (CC) North Landfill	Molinate	BMDL to 1.5		
	Mercury	BMDL to 0.6	0.024 Molinate	CCM-7
3. CC South Landfill	Molinate	ND to 0.1	0.23 Molinate	CCM-4
4. CC LeCreek Pond	Thiocarbamates	ND to 0.2	0.23 Molinate	CCM-4
5. LeMoyne LeCreek Pond	Chloride	ND to 240	367 Chloride	0-49
6. New Carbon Tetrachloride (CTC) Plant WWT Pond	None	-	169 Chloride	0-65
7. CC Old Neutralization Pond	Thiocarbamates	ND to 25	0.23 Molinate	CCM-4
8. Halby Treatment Pond	Thiocyanate	ND to 2,480	6 Thiocyanate	0-79
9. Old CTC Plant WWT Pond	Carbon Disulfide (CS2)	ND to 0.016	298 Carbon Tetrachloride	0-29/0-31
	Carbon Tetrachloride	ND to 0.001	55 Carbon Disulfide	
10. Old Carbon Disulfide Plant WWT Pond	CS2	ND to 0.008	298 Carbon Tetrachloride	0-29/0-31
	CTC	ND to 0.685	55 Carbon Disulfide	
11. Old Chlorine Plant WWT Pond	Mercury	1.4 to 24	159 Cl	0-73
12. LeMoyne Acid Plant WWT Pond	Iron	2800 to 25,000	0.0003 Carbon Disulfide	CNA-3
13. Cold Creek Swamp	Mercury	BMDL to 690	None	SCC-050
14. LeMoyne Swamp	Mercury	0.11 to 0.28	0.002 Carbon Disulfide	CNA-14

background soil sample. The corresponding downgradient well, NM-1, showed no mercury.

Carbon tetrachloride (CTC) was not found in the soil borings installed beneath the LeMoyne landfill, but it is seen at 0.25 mg/l in the ground water at well NM-1. CTC is known to be a localized ground-water contaminant that is extensively controlled in this area by the high withdrawal rate wells operated by Courtaulds North America (CNA) for industrial water supply. CNA usage dominates the local ground-water flow pattern, producing a gradient generally to the southwest with respect to well NM-1. To the south of NM-1, CNA withdrawl wells show levels of CTC ranging from non detectable to 0.0007 mg/l. If in the future, the CNA system were to be curtailed, modified or abandoned, there could be a need to install an additional interceptor system well to assure capture of the low levels of CTC in this area. However, in the opinion of Stauffer's staff geologist who has evaluated this data, the direction of ground-water flow in the absence of CNA pumping would tend to revert to the normal area flow pattern, which is toward the Mobile River.

The Safe Drinking Water Committee (National Academy of Science, Drinking Water and Health) determined that the estimates of lifetime risk for humans ingesting 1 X 10^{-3} mg carbon tetrachloride/l of water are 4.5-5.4 X 10^{-8} with 95% upper confidence limits of 1.0-1.1 X 10^{-7}. Even though the water in well NM-1 contained levels of carbon tetrachloride which exceeded 1 X 10^{-3} mg/l, there should be no risk to humans because this water is not anticipated to be ingested by humans or exposed to wildlife. In fact, carbon tetrachloride levels were below 1 X 10^{-3} mg/l by the time the water reached well CNA-11.

2. Cold Creek North Landfill - Most of the site-specific compounds analyzed for in the soil samples collected from this landfill were less than 1 mg/kg (see Table 5-2 in Section 5). The median level of molinate, the compound most frequently detected, was 0.1 mg/kg. Molinate was found in the downgradient well, CCM-7, at a level of 0.024 mg/l. This water is not available for ingestion by humans or other living organisms. Moreover, the mean molinate levels for all wells are below the proposed safe drinking water level of 0.2 mg/l (see Appendix XIX). Based on these low findings, this area is not considered a significant source of contamination.

3. Cold Creek South Landfill - As with the North landfill, no priority pollutants were found in the South landfill other than heavy metals within the common range for natural soils. Moreover, no site-specific compounds were found in soil borings under this area. For these reasons, this area is not considered a contaminant source.

4. Cold Creek LeCreek Pond - No priority pollutants except for heavy metals within the common range for natural soils were found. Moreover, except for two samples which contained thiocarbamates at or slightly above their limits of detection, no site-specific compounds were found in the soil samples collected from beneath the Cold Creek LeCreek pond. Based on these findings, this area is not considered a contaminant source.

5. LeMoyne LeCreek Pond - Of the 10 soil samples analyzed for site-specific compounds, one showed a

level of 240 mg/kg chloride, which is within the common range for natural soils. Two other soil samples contained low levels of chloride, and the remaining seven samples were non detectable for chloride. Because the heavy metals and chloride concentrations found beneath the LeMoyne LeCreek pond were within the common range for natural soils, this area is not considered a contaminant source.

6. New Carbon Tetrachloride Plant WWT Pond - No site-specific compounds were detected, and no priority pollutants other than heavy metals within the average range for natural soils were found beneath this area. Therefore, the new carbon tetrachloride plant WWT pond is not considered a source of contamination.

7. Cold Creek Old Neutralization Pond - Seven of the 10 soil samples analyzed for site-specific compounds contained thiocarbamates. The median level for each of the six thiocarbamates analyzed for varied from non detectable to 0.25 mg/kg. However, the closest downgradient well, CCM-4, showed thiocarbamate levels ranging from below the mean detection limit to 0.23 mg/l. Whereas the data could indicate that this area is a probable source of thiocarbamate contamination, only one thiocarbamate, molinate, was found in the ground water at 0.23 mg/l. The other thiocarbamates were present at 0.004 mg/l or less. Furthermore, at wells further downgradient, molinate is non detectable or present at detection-limit levels. Thus, although the Cold Creek old neutralization pond may be a source of thiocarbamate contamination, ultimately, the existing ground-water intercept system is capturing these trace amounts.

The molinate level of 0.23 mg/l exceeds the proposed safe drinking water level of 0.2 mg/l. However, water containing 0.23 mg/l molinate is not anticipated to be ingested by humans or other living organisms. In fact, as mentioned above, molinate levels were much lower (0.01 mg/l to below detection limits) in the next most immediate downgradient wells.

8. Halby Treatment Pond - Soil sampling at the HCC site was made within the area formerly occupied by a small pond. One boring, HTP-1, encountered apparent waste material and was discontinued at that point. Analysis of this waste showed high levels of copper (440 mg/kg), zinc (1170 mg/kg) and cyanide (240 mg/kg). A second boring within the pond and an angled bore beneath the pond were both at background levels of copper and zinc and had no detectable levels of cyanide. Site-specific sampling detected elevated levels of thiocyanate (see Table 5-5) in all three borings. Sodium thiocyanate has a low acute toxicity (LD_{50} for rats is 764 mg/kg's Sax, 1979). A low level of thiocyanate (6 mg/l) was detected in downgradient ground water at well 0-79. No other site-specific compounds were found in the ground water. Based on these findings, this area is presumed to be the probable source of thiocyanate found in ground water.

9. Old Carbon Tetrachloride Plant WWT Pond - Although only low levels of carbon tetrachloride and carbon disulfide were found in soil samples under this pond, downgradient wells, 0-29 and 0-31, showed high levels of these two contaminants. These levels of carbon tetrachloride (298 mg/l) and carbon disulfide (55 mg/l) are not considered safe for ingestion by humans or other living organisms. However, because the

existing withdrawal and treatment systems preclude access to this ground water, there is virtually no risk to humans or other organisms. The ground-water intercept system, which has been operating since 1981, controls ground-water flow in this area. Low levels of these compounds are evident at CNA wells south of the site property line probably because of migration prior to the installation of the intercept system (see Figure 5-7). The CNA system serves to effectively purge the area of any small residual quantities.

10. Old Carbon Disulfide Plant WWT Pond - This pond is similar to, and located adjacent to, the old carbon tetrachloride WWT pond. The discussion presented above in (9) regarding the old carbon tetrachloride WWT pond would apply to this pond as well.

11. Old Chlorine Plant WWT Pond - Two soil samples from below the pond area showed moderate levels of mercury (1.4 and 24 mg/kg) and levels of chloride up to 1200 mg/kg. At the downgradient well, 0-73, mercury is non detectable and chloride is within normal limits at 159 mg/l. On this basis, the old chlorine plant WWT pond does not appear to represent a source of contamination to ground water, which is the only potential route of exposure.

12. LeMoyne Acid Plant WWT Pond - Soil samples from beneath the pond contain only high levels of iron (up to 24,500 mg/kg). The only finding in the nearest downgradient well, CNA-3, was 0.0003 mg/l carbon disulfide (CS_2). The acid plant pond has no relationship to CS_2, and hence it would not appear to be a source of contamination.

13. Cold Creek Swamp - In addition to the high levels of mercury found in the swamp soil, low levels of thiocarbamates were also found (median level was 0.25 mg/kg). As discussed previously, the mercury present is probably in the sulfide form and is therefore immobile and insoluble. Analysis of downgradient ground water at well SCC-050 did not detect either mercury or thiocarbamates. Furthermore, no mercury was found in ground water anywhere on the entire site. It is concluded, therefore, that the Cold Creek Swamp is not a source of contamination to ground water.

Fish samples were collected at five swamp locations. Because of the very small individual fish size, an aggregate sample was taken, and analysis was performed on a homogenate i.e., whole fish. The range of mercury found was 0.59 mg/kg to 3.1 mg/kg for four locations, while a fifth point (BA-5) was considered a background sample and showed 0.42 mg/kg. Whereas the range may exceed the FDA established action level of 0.5 mg/kg for the edible portion of fish tissue, many of the fish were forage fish and unlikely to be eaten. The game fish found at the site were generally juveniles. Some of these may make their way to the Mobile River, and with lower ambient mercury concentrations, body burdens would decline over time because of growth and depuration. Human consumption of fish contaminated from the site but caught in the river is considered to be very unlikely.

14. LeMoyne Swamp - Soil/sediment samples were comparable to background levels for all heavy metals. The closest downgradient well, CNA-14, showed 0.002 mg/l of CS_2, but this may be attributed to contaminants present prior to closure of the LeMoyne landfill

which is also upgradient to the well. Because the compounds detected in soil from beneath the LeMoyne landfill where all within the average range for natural soils, this area is not considered a contaminant source.

GENERAL REFERENCES

Alesii, B.A. and W.H. Fuller (1976). The mobility of three cyanide forms in soils. pp. 213-223. In: Residual Management by Land Disposal. W.H. Fuller, ed., EPA, Cincinnatti, Ohio. PB 256768, 268 p.

American Conference of Governmental Industrial Hygienists (ACGIH) (1980). Documentation of the Threshold Limit Values. 4th ed. Cincinnati, Ohio.

Bariliak, I.R., I.A. Vasileva and L.P. Kalinovskaia (1975). Effect of small concentrations of carbon disulfide and hydrogen disulfide on intrauterine developments in rats. Arkh. Anat. Gistol. Embriol. 68(5):77-81.

Broderius, S.J. (1973). Determination of molecular hydrocyanic acid in water and studies of the chemistry and toxicity to fish of metal-cyanide complexes. Ph. D. Dissertation, Oregon State Univ., Corvallis, Ore. 287 p. Available from Univ. Microfilms International, No. 73-21299, Ann Arbor, Michigan.

Broderius, S.J. (1977). Personal Communication concerning the fate of cyanides in the aquatic environment. EPA Grant R 805291, December 8, 1977. Univ. of Minnesota, St Paul.

Cameron, G.R., C.R. Doniger and A.N.M. Hughes (1939). The toxicity of lauryl thiocyanate and N-butyl-carbitolthiocyanate (Lethane 384). J. Path. Bacteriol. 49:363-379.

Camp Dresser and McKee, Inc. (1985). Final Work Plan for Stauffer Chemical Cold Creek and LeMoyne Sites, Remedial Investigation/Feasibility Study, Mobile County, Alabama.

Carr, R.A. and P.E. Wilkness (1973). Mercury: Short term storage of natural waters. Environ. Sci Technol. 7: 62-63.

Doudoroff, D., et al. (1966). Acute toxicity to fish of solutions containing complex metal cyanides, in relation to concentration of molecular hydrocyanic acid. Trans. Am. Fish. Soc. 95:6.

Doull, J., Klaassen, C.D., and Amdur, M.O., eds. (1980). Casarett and Doull's Toxicology: The Basic Science of Poisons. 2nd ed. MacMillan Publishing Co.: New York. 778 p.

EPA (1979). Water-Related Environmental Fate of 129 Priority Pollutants. Vol. I: Introduction and Technical Background, Metals and Inorganics, Pesticides and PCBs. EPA PB 80-2004373.

GENERAL REFERENCES (Continued)

EPA (1979). Water-Related Environmental Fate of 129 Priority Pollutants: Vol. II. Halogenated Aliphatic Hydrocarbons, Halogenated Ethers, Monocyclic Aromatics, Phthalate Esters, Polycyclic Aromatic Hydrocarbons, Nitrosamines, and Miscellaneous Compounds. EPA PB 80-204381.

EPA (1980). Office of Water Regulation and Standards, Criteria and Standards Division EPA 440/5-80-037.

EPA (1984a). Health Assessment Document for Chromium. Environmental Criteria and Assessment Office. Research Triangle Park, NC. EPA-600/8-83-014F.

EPA (1984b). Mercury Health Effects Update. Health Issue Assessment. Office of Health and Environmental Assessment. Washington D.C. EPA-600/8-84-019F.

EPA (1984c). Health Effects Assessment for Mercury. Office of Research and Development. EPA 1540011-861042. September, 1984.

EPA (1984d). Health Assessment Document for Carbon Tetrachloride. Office of Research and Development; Office of Health and Environmental Assessment. EAP-600/8-82-001F, September, 1984.

EPA (1984e). Health Effects Assessment for Carbon Tetrachloride Office of Research and Development, Office of Health and Environmental Criteria. EPA/540/1-86-039, September, 1984.

EPA (1985). Drinking Water Criteria Document for Cyanides (Final Draft). Environmental Criteria and Assessment Office. EPA-600/5-84-192.

EPA (1985). The Endangerment Assessment Handbook. Office of Waste Programs Enforcement. Washington D.C.

EPA (1986). Superfund Public Health Evaluation Manual. EPA 540/1-86/060 October, 1986.

ERT (1985). Hydrogeologic Investigation.

Geological Survey of Alabama (1968). Geology of the Alabama Coastal Plain. Circular 47.

Geological Survey of Alabama (1972). Water Availability in Mobile County, Alabama. Map 121.

Gilman, A.G., L.S., Goodman and A. Gilman (1980). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 6th ed. MacMillan Publishing Company, Inc.: New York.

Gosselin, R.E., H.C. Hodge and R.P. Smith (1984). Clinical Toxicology of Commercial Products. 5th ed. The Williams and Wilkins Company: Baltimore, M.D.

Groundwater Associates, Inc. (1978). Hydrogeological Investigation of Ground Water Contamination.

Groundwater Associates, Inc. (1979). Hydrogeological Investigation of Ground Water. Report No. 2.

Hammond, P.B., and Beliles, R.P. (1980). Metals. In Boull, J., Klaassen, C.D., and Andur, M.D., eds. Casarett and Doull's Toxicology. 2nd ed. MacMillon: New York. p. 409-467.

Hickman and Owens (1978). Soil Survey of Mobile County, Alabama.

International Agency for Research on Cancer (IARC) (1979). IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. Vol. 15: Carbon tetrachloride. World Health Organization, Lyon, France.

Klaassen, C.D., M.O. Amdur, and J. Doull, eds (1986). Casarett and Doull's Toxicology: The Basic Science of Poisons, 3rd ed. Macmillan Publishing Company: New York.

McConnell, G., D.M. Ferguson and C.R. Pearson (1975). Chlorinated Hydrocarbons and the environment. Endeavor (XXXIV): 13-18.

National Institute for Occupational Safety and Health (NIOSH) (1976). Criteria for a Recommended Standard-Occupational Exposure to Chlorine. Washington, D.C. DHEW Publication No. (NIOSH) 76-230.

National Research Council (NRC) (1982). Drinking Water and Health. Vol 4. Safe Drinking Water Committee. National Academy Press: Washington D.C.

Neely, W.B., D.R. Branson and G.E. Glau (1974). Partition Coefficient to measure bioconcentration potential of organic chemicals in fish. Environ. Sci Technol. 8: 1113-1115.

GENERAL REFERENCES (Continued)

Ohkawa, H. R. Ohkawa, I. Yamamoto and J.E. Casida (1972). Enzymatic mechanisms and toxicological significance of hydrogen cyanide liberation from various organo thiocyanates and organonitriles in mice and houseflies. Pesticide Biochem. Physiol. 2:95-112.

Pearson, C.R. and G. McConnell (1975). Chlorinated C_1 and C_2 hydrocarbons in the marine environment. Proc. Roy. Soc. London B. 189: 305-322.

Prickett, T., Kaymik, T., and Lannaquist C. (1981). A "Random-Walk" solute transport model for selected ground water quality evaluations.

Ramamoorthy, S. and B.R. Rust (1976). Mercury sorption and desorption characteristics of some Ottawa River sediments. Can J. Earth Sci. 13: 530-536.

Reimers, R.S. and P.A. Krenkel (1974). Kinetics of mercury adsorption and desorption in sediments. Jour. Water Poll. Control Fed. 46 (2): 352-365.

Riccio, J.F., Martin, J.D., and Lamb, G.M. (1973). Development of a Hydrologic Concept for the Greater Mobile Metropolitan-Urban Environment. Geological Survey of Alabama. 171 p.

Sax, E.J. (1984). Dangerous Properties of Industrial Materials, 6th ed. Van Nostrand Reinhold Co; New York.

Sittig, M. (1981). Handbook of Toxic and Hazardous Materials. New Jersey: Noyes.

Smyth, H.F., Smyth, H.F., Jr., and Carpenter, C.P. (1936). The chronic toxicity of carbon tetrachloride: Animal exposure and field studies. J. Ind. Hyg. Toxicol. 18:277-298.

Spyker, D.A., A.G. Gallonosa and P.M. Suratt (1982). Health effects of acute carbon disulfide exposure. J. Toxicol. Clin. Toxicol. 19:87-93.

Stauffer Chemical Co. (1987). Cold Creek and LeMoyne Sites Remedial Investigation, Mobile County, Alamaba. Rev. 1 July 1987 Draft Report.

Thom, N.S. and A.R. Agg (1975). The breakdown of synthetic organic compounds in biological processes. Proc. Roy. Soc. London B 189: 347-357.

U.S. Department of Commerce (1980). 1980 Census of Population and Housing Alabama. U.S. Department of Commerce, Bureau of Census. PHC80-V-2.

Verschueren, K. (1977). Handbook of Environmental Data on Organic Chemicals. Van Nostrand/Reinhold Press, New York. 659 p.

von Oettinger, W.F., W.C. Hueper and W. Deichmann-Grubler (1936). The pharmacologic action and pathologic effects of alkyl thiocyanates in relation to their chemical constitution and physical chemical properties. J. Ind. Hyg. Toxicol. 18:310-336.

Weisburger, E.K. (1977). Carcinogenicity studies on halogenated hydrocarbons. Environ. Health Perspect. 21:7-16.

APPENDIX I

LIST OF PROPOSED SAMPLES AND LIST OF SAMPLES ACTUALLY COLLECTED

SWAMP SAMPLES - PHASE ONE

TABLE 4-

3 10 00184

ANALYTICAL PARAMETERS

C-COMPOSITE

SAMPLE NO. AS SHOWN IN FIGURES AND 4-2A	SOIL	WATER	BIOLOGICAL	BODS	P.P. METALS	P.P. VOLATILES	P.P. PESTICIDES & PCBS	THIOCARBAMATES	B-BOD-BOL	CHLORIDES	PRIORITY POLLUTANTS	CARBON TETRACHLORIDE	CARBON DISULFIDE	MERCURY		NOTES:
COLD CREEK SWAMP																
CCS-1S	1							1		1	1					4 FT. COMPOSITE
CCS-2S	1							1		1	1					″
CCS-3S	1							1		1	1					″
CCS-2-1S	1													1		″
CCS-2-1W	1													1		″
CCS-3-1S	1													1		″
CCS-3-1W	1													1		″
CCS-4-1S	1													1		″
CCS-4-2S	1													1		″
CCS-4-3S	1													1		″
CCS-4-1W	1													1		″
CCS-4-2W	1													1		″
CCS-4-3W	1													1		″
CCS-5-1S	1													1		″
CCS-5-2S	1													1		″
CCS-5-1W	1													1		″
CCS-5-2W	1													1		″
CCS-6-1S	1													1		″
CCS-6-1W	1													1		″
CCS-6-2W	1													1		″
CCS-7-1S	1													1		″
CCS-7-2S	1													1		″
CCS-7-3S	1													1		
CCS-7-4S	1													1		
CCS-7-5S	1													1		″
CCS-7-6S	1													1		″
CCS-7-1W	1													1		″
CCS-7-2W	1													1		″
CCS-7-3W	1													1		″
CCS-8-1S	1													1		″
CCS-8-2S	1													1		″
CCS-8-3S	1													1		″
CCS-8-4S	1													1		″
CCS-8-1W	1													1		″
QA SAMPLES	4													3		
BA-1			1													
BA-2			1													
BA-3			1													
BA-4			1													
BA-5			1													
SW-01-1W		1			1											
SW-01-2W		1			1											
SW-11-1W		1				1										
SW-11-2W		1				1										
QA SAMPLES		1			1	1										
LONGVIEW SWAMP																
LS-1S	1							1		1	1					4 FT. COMPOSITE
LS-2S	1							1		1	1					″
LS-3S	1							1		1	1					″
LS-4S	1							1		1	1					″
QA SAMPLE	1							1		1	1					
TOTALS	42	5	4		3	3		8		8	8			34		

3 10 00185

SWAMP SAMPLES – PHASE TWO

1-1b

TABLE 4-1A

ANALYTICAL PARAMETERS

C–COMPOSITE

SAMPLE NO. AS SHOWN ON FIGURES 4-2 AND 4-2A	SOIL	WATER	IRON	P.P. METALS	P.P. VOLATILES	P.P. PESTICIDES & PCBS	THIOCARBAMATES	S-SO3-SO4	CHLORIDES	PRIORITY POLLUTANTS	CARBON TETRACHLORIDE	CARBON DISULFIDE	MERCURY
COLD CREEK SWAMP													
CCS-1S	S									C			S
CCS-2S	S									C			S
CCS-3S	S									C			S
CCS-4S	S									C			S
CCS-5S	S									C			S
CCS-6S	S									C			S
CCS-7S	S									C			S
CCS-8S	S									C			S
LeMOYNE SWAMP:													
LS-1S	S									J			S
LS-2S	S									J			
LS-3S	S									J			
LS-4S	S									J			
QA SAMPLES	6									2			6
TOTALS	66									22			66

NOTES:

Contingency Samples: Analytes will be determined based on interpretation of phase one samples. Cost estimates are based on 30 foo borings with 5' sample intervals and priority pollutant analysis as indicated.

WELL SAMPLES (SOURCE)

TABLE 4-2

3 10 00186

ANALYTICAL PARAMETERS

C-COMPOSITE

SAMPLE NO. AS SHOWN ON FIGURE	SOIL	WATER		IRON	P.P. METALS	P.P. VOLATILES	P.P. PESTICIDES & PCBS	THIOCARBAMATES	ORGANO PHOSPHATES	CHLORIDES	PRIORITY POLLUTANTS	THIOCYANATE	CARBON DISULFIDE	MERCURY	CARBON TETRACHLORIDE	NOTES:
0-29-1W		1						1	1	1			1	1	1	
0-31-1W		1						1	1	1			1	1	1	
0-32-1W		1						1	1	1			1	1	1	
0-39-1W		1						1	1	1			1	1	1	
0-40-1W		1						1	1	1			1	1	1	
0-45-1W		1						1	1	1			1	1	1	
0-49-1W		1						1	1	1			1	1	1	
0-58-1W		1						1	1	1			1	1	1	
0-64-1W		1						1	1	1			1	1	1	
0-65-1W		1						1	1	1			1	1	1	
0-73-1W		1						1	1	1			1	1	1	
ECM-4-1W		1						1	1	1			1	1	1	
ECM-7-1W		1						1	1	1	1		1	1	1	
W-1		1						1	1	1	1		1	1	1	
W-2		1						1	1	1	1		1	1	1	
QA SAMPLES		2						2	2	2	1		2	2	2	
TOTAL		17						17	17	17	4		17	17	17	

POND & LAGOON SAMPLES

TABLE I-1d

3 10 00187

ANALYTICAL PARAMETERS

C-COMPOSITE

SAMPLE NO. AS SHOWN ON FIGURES	SOIL	WATER	IRON	P.P. METALS	P.P. VOLATILES	P.P. PESTICIDES & PCBS	THIOCARBAMATES	S-SO3-SO4	CHLORIDES	PRIORITY POLLUTANTS	CARBON TETRACHLORIDE	CARBON DISULFIDE	CH	NOTES:
														NEUTRALIZATION
														Cold Creek Pond (50°845°)
CCAP-1S	6						5			C				Boring 1
CCAP-2S	6						5			C				Boring 2
														Cold Creek LeCreek WWT Pond (50°845°)
CCLP-1S	6						5			C				Boring 1
CCLP-2S	6						5			C				Boring 2
														Malby WWT Pond (Max. 40' or GW-vert
HTP-1S	6									C			5	Boring 1
HTP-2S	6									C			5	Boring 2
														Old Cb Plant WWT Pond
MTP-1S	6								5	C				Boring 1
MTP-2S	6								5	C				Boring 2
														New CTC Plant WWT Pond (50°845°)
NCTC-1S	6									C	5	5		Boring 1
NCTC-2S	6									C	5	5		Boring 2
														Old CTC Plant WWT Pond (50°845°)
OCTC-1S	6									C	5	5		Boring 1
OCTC-2S	6									C	5	5		Boring 2
														Old CS2/CTC Plant WWT Pond (50°845°
OCS-1S	6									C	5	5		Boring 1
OCS-2S	6									C	5	5		Boring 2
														Acid Plant WWT Pond (50°845°)
APP-1S	6		5					5		C				Boring 1
APP-2S	6		5					5		C				Boring 2
														LeMoyne Creek WWT Pond (50°845°)
LLP-1S	6								5	C				Boring 1
LLP-2S	6								5	C				Boring 2
														Pond Water Samples
CCLP-IW		1								1				Cold Creek LeCreek WWT Pond
NCTC-IW		1								1				New CTC Plant WWT Pond
LLP-IW		1								1				LeMoyne Creek WWT Pond
QA Samples	11		1				2	1	2	2	3	3	1	
		1								1				
														WWT- Waste Water Treatment
TOTAL	119	4	11				22	11	22	24	33	33	11	

LANDFILL SAMPLES

TABLE 4-4

3 10 00188

ANALYTICAL PARAMETERS

C–COMPOSITE

SAMPLE NO. AS SHOWN ON FIGURES	SOIL	WATER	COVER	ORGANO PHOSPHATES	P.P. METALS	P.P. VOLATILES	P.P. PESTICIDES & PCBS	THIOCARBAMATES	S-SO3-SO4	CHLORIDES	PRIORITY POLLUTANTS	CARBON TETRACHLORIDE	CARBON DISULFIDE	VANADIUM	PHOSPHORUS	NOTES:
SCC-																North Drumfield (50°945°)
NLF-1S	6			5				5			C			C	5	Boring 1
NLF-2S	6			5				5			C			C	5	Boring 2
																South Drumfield (50°945°)
SLF-1S	6							5			C			C	5	Boring 1
SLF-2S	6			5				5			C			C	5	Boring 2
																LeMoyne Landfill (50°945°)
LLF-1S	6							C		5	C		5	5	C	Boring 1
LLF-2S	5							C		[illegible]	[illegible]		5	5	C	Boring 2
LLF-3S	6							C		5	C		5	5	C	Boring 3
LLF-4S	6							C		5	C		5	5	C	Boring 4
LLF-5S	6							C		5	C		5	5	C	Boring 5
LLF-6S	6							C		5	C		5	5	C	Boring 6
LLF-7S	6							[illegible]		5	[illegible]		5	5	C	Boring 7
LLF-8S	6							C		5	C		5	5	C	Boring 8
																Polyolefin Cover
NLF-1P			1													North Landfill
SLF-1P			1													South Landfill
LLF-1P			1													LeMoyne Landfill
QA SAMPLES	7			2				3		4	[illegible]		6	4	3	
TOTALS	79			22				31		[illegible]	13		14	48	31	

3 10 00189

WELL SAMPLES (AREA)

TABLE 4-5

ANALYTICAL PARAMETERS

C–COMPOSITE

SAMPLE NO. AS SHOWN ON FIGURES	SOIL	WATER		IRON	P.P. METALS	P.P. VOLATILES	P.P. PESTICIDES & PCBS	THIOCARBAMATES	ORGANO PHOSPHATES	CHLORIDES	PRIORITY POLLUTANTS	THIOCYANATE	CARBON DISULFIDE	MERCURY	CARBON TETRACHLORIDE	NOTES:
SCC-05-1W		1						1	1	1	1		1			
-08-1W		1						1	1	1			1			
-014-1W		1						1	1	1	1		1			
-016-1W		1						1	1	1	1		1			
-017-1W		1						1	1	1	1		1			
-018-1W		1						1	1	1	1	1	1			
-022-1W		1						1		1			1	1		
-023-1W		1						1		1			1	1		
-024-1W		1						1		1			1			
-025-1W		1						1		1		1	1			
-050-1W		1						1	1	1	1		1			
-051-1W		1						1		1			1	1		
-052-1W		1						1	1	1			1	1		
-078-1W		1						1	1	1			1	1		
-079-1W		1						1	1	1		1	1	1		
-089-1W		1						1	1	1		1	1	1		
-LM5-1W		1						1	1	1			1	1		
-LM6-1W		1						1	1	1			1	1		
-LM7-1W		1						1	1	1			1	1		
-LM10-1W		1						1	1	1			1	1		
-CC12-1W		1						1	1	1	1		1	1		
-CNA3-1W		1						1	1	1			1	1		
-CNA6-1W		1						1	1	1			1	1	1	
-CNA7-1W		1						1	1	1			1	1	1	
-CNA8-1W		1						1	1	1			1	1	1	
-CNA9-1W		1						1	1	1			1	1		
-CNA11-1W		1						1	1	1			1	1	1	
-CNA13-1W		1						1	1	1			1	1		
-CNA14-1W		1						1	1	1			1	1		
-CNA15-1W		1						1	1	1			1	1		
-CNA16-1W		1						1	1	1			1	1	1	
-CAN17-1W		1						1	1	1			1	1		
-CNAM-1-1W		1						1	1	1			1	1	1	
-CNAM-22-1W		1						1	1	1			1	1		
-CNAM-25-1W		1						1	1	1			1	1		
-CNAM-28-1W		1						1	1	1			1	1	1	
-CNAM-30-1W		1						1	1	1			1	1		
QA SAMPLES		4						4	3	4	1	1	4	3	1	
TOTALS		41						41	35	41	8	5	41	31	8	

Sample Send out to Environmental Testing and Certification

	Project	CC/Le	ERC SAMPLE #			Code	Comments	DATE SENT	Analytes							
1	Batch #1	Area	8105	1	Water	SOC-OC-12		5/5/86	pp	Cl			CS2		Th	OP
2		Area	8105	2	Water	SOC-017		5/5/86	pp	Cl			CS2		Th	OP
3		Area	8105	3	Water	SOC-05		5/5/86	pp	Cl			CS2		Th	OP
4		Area	8105	4	Water	SOC-050		5/5/86	pp	Cl			CS2		Th	OP
5		Area	8105	5	Water	SOC-014		5/5/86	pp	Cl			CS2		Th	OP
6		Area	8105	6	Water	SOC-018		5/5/86	pp	Cl	SCN		CS2		Th	OP
7		Area	8105	7	Water	SOC-016		5/5/86	pp	Cl			CS2		Th	OP
8		Ponds	8105	8	Water	CCM-7-1		5/5/86	pp	Cl			CS2	CTC	Th	OP
9		Ponds	8105	9	Water	CCM-7-1	dup 8	5/5/86	pp	Cl			CS2	CTC	Th	OP
10		Ponds	8105	10	Water	CCM-7-1	Spike 8	5/5/86	pp	Cl			CS2	CTC	Th	OP
11		Ponds	8105	11	Water	CCM-7-1	Blank	5/5/86	pp	Cl	SCN		CS2	CTC	Th	OP
12		Ponds	8105	12	Water		Blanks pp	5/5/86	pp	Cl	SCN		CS2	CTC	Th	OP
13		Ponds	8105	13	Water	NM-1		5/5/86	pp	Cl			CS2	CTC	Th	OP
14		Ponds	8105	14	Water	NM-2		5/5/86	pp	Cl			CS2	CTC	Th	OP
15		Ponds	8105	15	Water	NCTC		5/5/86	pp							
16		Ponds	8105	16	Water	LLP		5/5/86	pp							
17		Ponds	8105	17	Water	CCLP		5/5/86	pp							
18		Swamp	8105	18	Soil	SW-01-1s		5/5/86	pp metals							
19		Swamp	8105	19	Water	SW-11-1w		5/5/86	pp voa							
20		Swamp	8105	20	Soil	SW-11-1s		5/5/86	pp voa							
21		Swamp	8105	21	Water	SW-01-1w		5/5/86	pp metals							
22	Batch #2	Swamp	8105	22	Soil	LS-4S		5/15/86	pp	Cl					Th	
23		Swamp	8105	23	Soil	LS-1S		5/15/86	pp	Cl					Th	
24		Swamp	8105	24	Soil	LS-2S		5/15/86	pp	Cl					Th	
25		Swamp	8105	25	Soil	LS-3S		5/15/86	pp	Cl					Th	
26		Swamp	8105	26	Soil	CCS-1S		5/15/86	pp	Cl					Th	
27		Swamp	8105	27	Soil	CCS-1S	dup 26	5/15/86	pp	Cl					Th	
28		Swamp	8105	28	Soil	CCS-2S		5/15/86	pp	Cl					Th	
29		Swamp	8105	29	Soil	CCS-2-1E		5/15/86				Hg				
30		Swamp	8105	30	Soil	CCS-2-1W		5/15/86				Hg				
31		Swamp	8105	31	Soil	CCS-3S		5/15/86	pp	Cl					Th	
32		Swamp	8105	32	Soil	CCS-3-1W		5/15/86				Hg				
33		Swamp	8105	33	Soil	CCS-3-1E		5/15/86				Hg				
34		Swamp	8105	34	Soil		blank	5/15/86	pp	Cl					Th	
35		Swamp	8105	35	Soil	CCS-4-1E		5/15/86				Hg				
36		Swamp	8105	36	Soil	CCS-4-2E		5/15/86				Hg				
37		Swamp	8105	37	Soil	CCS-4-3E		5/15/86				Hg				
38	Batch #3	Swamp	8105	38	Soil	CCS-4-3W		5/16/86				Hg				
39		Swamp	8105	39	Soil	CCS-4-2W		5/16/86				Hg				
40		Swamp	8105	40	Soil	CCS-4-1W		5/16/86				Hg				
41		Swamp	8105	41	Soil	CCS-5-2W		5/16/86				Hg				
42		Swamp	8105	42	Soil	CCS-5-1W		5/16/86				Hg				
43		Swamp	8105	43	Soil	CCS-5-2E		5/16/86				Hg				
44		Swamp	8105	44	Soil	CCS-5-1E		5/16/86				Hg				
45		Swamp	8105	45	Soil	CCS-6-1E		5/16/86				Hg				
46		Swamp	8105	46	Soil	CCS-6-1W		5/16/86				Hg				
47		Swamp	8105	47	Soil	CCS-6-1W	Dup 46	5/16/86				Hg				
48		Swamp	8105	48	Soil	CCS-6-2W		5/16/86				Hg				
49		Swamp	8105	49	Soil	CCS-7-3W		5/16/86				Hg				
50		Swamp	8105	50	Soil	CCS-7-2W		5/16/86				Hg				

Th(Thiocarbamates),OP(Organophosphates),CTC(Carbon Tetrachloride),pp(Priority Pollutants)

3 10 00190

3 10 00191

Sample Send out to Environmental Testing and Certification

	Project	CC/le	ERC SAMPLE #			Code	Comments	DATE SENT	Analytes						
51		Swamp	8105	51	Soil	CCS-7-1W		5/16/86			Hg				
52		Swamp	8105	52	Soil	CCS-7-1E		5/16/86			Hg				
53		Swamp	8105	53	Soil	CCS-7-2E		5/16/86			Hg				
54		Swamp	8105	54	Soil		Blank	5/16/86			Hg				
55	Batch 4	Swamp	8105	55	Soil	CCS-7-3E		5/20/86			Hg				
56		Swamp	8105	56	Soil	CCS-7-4E		5/20/86			Hg				
57		Swamp	8105	57	Soil	CCS-7-5E		5/20/86			Hg				
58		Swamp	8105	58	Soil	CCS-7-6E		5/20/86			Hg				
59		Swamp	8105	59	Soil	CCS-8-1W		5/20/86			Hg				
60		Swamp	8105	60	Soil	CCS-8-1E		5/20/86			Hg				
61		Swamp	8105	61	Soil	CCS-8-2E		5/20/86			Hg				
62		Swamp	8105	62	Soil	CCS-8-3E		5/20/86			Hg				
63		Swamp	8105	63	Soil	CCS-8-4E		5/20/86			Hg				
64	Batch 5	Area	8105	64	Water	SCC-022		5/21/86	Cl		Hg	CS2		Th	
65		Area	8105	65	Water	SCC-023		5/21/86	Cl		Hg	CS2		Th	
66		Area	8105	66	Water	SCC-051		5/21/86	Cl		Hg	CS2		Th	
67		Area	8105	67	Water	SCC-24		5/21/86	Cl			CS2		Th	
68		Area	8105	68	Water	SCC-25		5/21/86	Cl	SCN		CS2		Th	
69		Area	8105	69	Water	SCC-08		5/21/86	Cl			CS2		Th	OP
70		Area	8105	70	Water	SCC-79		5/21/86	Cl	SCN	HG	CS2		Th	OP
71		Area	8105	71	Water	SCC-080		5/21/86	Cl	SCN	HG	CS2		Th	OP
72		Area	8105	72	Water	SCC-079	Spike 70	5/21/86	Cl	SCN	HG	CS2*		Th	OP
73		Area	8105	73	Water	SCC-079	dup 70	5/21/86	Cl	SCN	HG	CS2		Th	OP
74		Area	8105	74	Water	SCC-079	Blank	5/21/86	Cl	SCN	HG	CS2		Th	OP
75		Area	8105	75	Water	SCC-079	Blanks sp	5/21/86	Cl	SCN	HG	CS2		Th	OP
76	Batch 6	Ponds	8105	76	Water	O-58		5/28/86	Cl		HG	CS2	CTC	Th	OP
77		Ponds	8105	77	Water	O-64		5/28/86	Cl		HG	CS2	CTC	Th	OP
78		Ponds	8105	78	Water	O-65		5/28/86	Cl		HG	CS2	CTC	Th	OP
79		Ponds	8105	79	Water	O-49		5/28/86	Cl		HG	CS2	CTC	Th	OP
80		Ponds	8105	80	Water	CCM-4		5/28/86	Cl		HG	CS2	CTC	Th	OP
81		Ponds	8105	81	Water	O-73		5/28/86	Cl		HG	CS2	CTC	Th	OP
82		Ponds	8105	82	Water	O-32		5/28/86	Cl		HG	CS2	CTC	Th	OP
83		Ponds	8105	83	Water	O-39		5/28/86	Cl		HG	CS2	CTC	Th	OP
84		Ponds	8105	84	Water	O-39	Spike 83	5/28/86	Cl		HG	CS2	CTC	Th	OP
85		Ponds	8105	85	Water	O-39	dup 83	5/28/86	Cl		HG	CS2	CTC	Th	OP
86		Area	8105	86	Water	SCC-52		5/28/86	Cl		HG	CS2	***	Th	OP
87		Area	8105	87	Water	SCC-78		5/28/86	Cl		HG	CS2	***	Th	OP
88		Ponds	8105	88	Water	O-39	Blank	5/28/86	Cl		HG	CS2	CTC	Th	OP
89		Ponds	8105	89	Water		Blank spi	5/28/86	Cl		HG	CS2	CTC	Th	OP
90		Ponds	8105	90	Water	O-41		5/28/86	Cl		HG	CS2	CTC	Th	OP
91		Ponds	8105	91	Water	O-45		5/28/86	Cl		HG	CS2	CTC	Th	OP
92		Ponds	8105	92	Water	O-31	Split CDM	5/28/86	Cl		HG	CS2	CTC	Th	OP
93		Ponds	8105	93	Water	O-29	Split CDM	5/28/86	Cl		HG	CS2	CTC	Th	OP
94		Ponds	8105	94	Water	O-29	CDM Spike	5/28/86			HG	CS2	CTC	Th	OP
95		Ponds	8105	95	Water		CDM Blank	5/28/86			HG	CS2	CTC	Th	OP
96	Batch 7	Area	8106	1	Water	SCC1M-7		6/3/86	Cl		HG	CS2		Th	OP
97		Area	8106	2	Water	SCC1M-10		6/3/86	Cl		HG	CS2		Th	OP
98		Area	8106	3	Water	SCC1M-5		6/3/86	Cl		HG	CS2		Th	OP
99		Area	8106	4	Water	SCC1M-6		6/3/86	Cl		HG	CS2		Th	OP
100		Area	8106	5	Water	CNAM-30		6/[illegible]/86	Cl		HG	CS2		Th	OP

3 10 00192

Sample Send out to Enviro ... cing and Certification

	Project	QC/Le	ERC	SAMPLE #		Code	Comments	Date SENT	Analytes						
101		Area	8106	6	Water	CNA-15		6/3/86	Cl		HG	CS2		Th	OP
102		Area	8106	7	Water	CNAM-25		6/3/86	Cl		HG	CS2		Th	OP
103		Area	8106	9	Water	CNAM-28		6/3/86	Cl		HG	CS2	CTC	Th	OP
104		Area	8106	10	Water	CNAM-1		6/3/86	Cl		HG	CS2	CTC	Th	OP
105		Area	8106	11	Water	CNAM-22		6/3/86	Cl		HG	CS2		Th	OP
106		Area	8106	12	Water	CNA-9		6/3/86	Cl		HG	CS2		Th	OP
107		Area	8106	13	Water	CNA-3		6/3/86	Cl		HG	CS2		Th	OP
108		Area	8106	14	Water	CNA-17		6/3/86	Cl		HG	CS2		Th	OP
109		Area	8106	15	Water	CNA-14		6/3/86	Cl		HG	CS2		Th	OP
110		Area	8106	16	Water	CNA-13		6/3/86	Cl		HG	CS2		Th	OP
111		Area	8106	17	Water	CNA-7		6/3/86	Cl		HG	CS2	CTC	Th	OP
112		Area	8106	18	Water	CNA-11		6/3/86	Cl		HG	CS2	CTC	Th	OP
113		Area	8106	19	Water	CNA-6		6/3/86	Cl		HG	CS2	CTC	Th	OP
114		Area	8106	20	Water	CNA-16		6/3/86	Cl		HG	CS2	CTC	Th	OP
115		Area	8106	21	Water	CNA-16	Spike 20	6/3/86	Cl		HG	CS2	CTC	Th	OP
116		Area	8106	22	Water	CNA-16	dup 20	6/3/86	Cl		HG	CS2	CTC	Th	OP
117		Area	8106	23	Water	CNA-16	Blank	6/3/86	Cl		HG	CS2	CTC	Th	OP
118		Area	8106	24	Water	CNA-16	Blank Spi	6/3/86	Cl		HG	CS2	CTC	Th	OP
119	Batch 8	Ponds	8106	27	Soil	APP-1S co	Split EPA	6/19/86 pp							
120		Ponds	8106	28	Soil	APP-1S 10'		6/19/86	Fe	S,SO3,SO4					
121		Ponds	8106	29	Soil	APP-1S 20'		6/19/86	Fe	S,SO3,SO4					
122		Ponds	8106	30	Soil	APP-1S 30'		6/19/86	Fe	S,SO3,SO4					
123		Ponds	8106	31	Soil	APP-1S 40'		6/19/86	Fe	S,SO3,SO4					
124		Ponds	8106	32	Soil	APP-1S 50'		6/19/86	Fe	S,SO3,SO4					
125		Ponds	8106	35	Soil	APP-2S com.		6/19/86 pp							
126		Ponds	8106	36	Soil	APP-2S 10'		6/19/86	Fe	S,SO3,SO4					
127		Ponds	8106	37	Soil	APP-2S 20'		6/19/86	Fe	S,SO3,SO4					
128		Ponds	8106	38	Soil	APP-2S 20	Dup 37	6/19/86	Fe	S,SO3,SO4					
129		Ponds	8106	39	Soil	APP-2S 30'		6/19/86	Fe	S,SO3,SO4					
130		Ponds	8106	40	Soil	APP-2S 40'		6/19/86	Fe	S,SO3,SO4					
131		Ponds	8106	41	Soil	APP-2S 50'		6/19/86	Fe	S,SO3,SO4					
132		Ponds	8106	42	Soil		Blank	6/19/86 pp	Fe*	S,SO3,SO4*					
133		Ponds	8106	43	Soil	APP-2S co	Dup 35	6/19/86 pp							
134		Ponds	8106	44	Soil	MTP-1S com.		6/19/86 pp							
135		Ponds	8106	45	Soil	MTP-1S 10'		6/19/86	Cl						
136		Ponds	8106	46	Soil	MTP-1S 20'		6/19/86	Cl						
137		Ponds	8106	47	Soil	MTP-1S 30'		6/19/86	Cl						
138	Batch 9	Ponds	8106	52	Soil	MTP-2S com.		6/27/86 pp							
139		Ponds	8106	53	Soil	MTP-2S 10'		6/27/86	Cl						
140		Ponds	8106	54	Soil	MTP-2S 20'		6/27/86	Cl						
141		Ponds	8106	55	Soil	NCTC-1S com.		6/27/86 pp							
142		Ponds	8106	56	Soil	NCTC-1S 10'		6/27/86				CS2	CTC		
143		Ponds	8106	57	Soil	NCTC-1S 20'		6/27/86				CS2	CTC		
144		Ponds	8106	58	Soil	NCTC-1S 30'		6/27/86				CS2	CTC		
145		Ponds	8106	59	Soil	NCTC-1S 40'		6/27/86				CS2	CTC		
146		Ponds	8106	60	Soil	NCTC-1S 50'		6/27/86				CS2	CTC		
147		Ponds	8106	61	Soil	NCTC-2S com.		6/27/86 pp							
148		Ponds	8106	62	Soil	NCTC-2S 10'		6/27/86				CS2	CTC		
149		Ponds	8106	63	Soil	NCTC-2S 20'		6/27/86				CS2	CTC		
150		Ponds	8106	64	Soil	NCTC-2S 30'		6/27/86				CS2	CTC		

Th(Thiocarbamates),OP(Organophosphates),CTC(Carbon Tetrachloride),pp((Priority Pollutants)

Sample Send out to Environme   sting and Certification

		Project	CC/Le	ERC SAMPLE #		Code	Comments	DA' SENT		Analytes					
151		Ponds	8106	65	Soil	NCTC-2S 40'		6/27/86					CS2	CTC	
152		Ponds	8106	66	Soil	NCTC-2S 50'		6/27/86					CS2	CTC	
153		Ponds	8106	67	Soil	LLP-1S com.		6/27/86	pp						
154		Ponds	8106	68	Soil	LLP-1S 10'		6/27/86		Cl					
155		Ponds	8106	69	Soil	LLP-1S 10 Dup 68		6/27/86		Cl					
156	Batch 10	Ponds	8106	70	Soil	LLP-1S 20'		6/27/86		Cl					
157		Ponds	8106	71	Soil	LLP-1S 30'		6/27/86		Cl					
158		Ponds	8106	72	Soil	LLP-1S 40'		6/27/86		Cl					
159		Ponds	8106	73	Soil	LLP-1S 50'		6/27/86		Cl					
160		Ponds	8106	74	Soil		Blank	6/27/86	pp						
161		Ponds	8106	75	Soil		Blank	6/27/86		Cl			CS2	CTC	
162		Ponds	8106	76	Soil	LLP-2S com.		6/27/86	pp						
163		Ponds	8106	77	Soil	LLP-2S co Dup 76		6/27/86	pp						
164		Ponds	8106	78	Soil	LLP-2S 10'		6/27/86		Cl					
165		Ponds	8106	79	Soil	LLP-2S 20'		6/27/86		Cl					
166		Ponds	8106	80	Soil	LLP-2S 30'		6/27/86		Cl					
167		Ponds	8106	81	Soil	LLP-2S 40'		6/27/86		Cl					
168		Ponds	8106	82	Soil	LLP-2S 50'		6/27/86		Cl					
169	Batch 11	Ponds	8106	83	Soil	LLF-1s com.		7/19/86	pp			P			Th
170		Ponds	8106	84	Soil	LLF-1s 10'		7/19/86		Cl	V		CS2		
171		Ponds	8106	85	Soil	LLF-1s 10Dup 84		7/19/86		Cl	V		CS2		
172		Ponds	8106	86	Soil	LLF-1s co dup 83		7/19/86	pp			P			Th
173		Ponds	8106	88	Soil	LLF-1s 20'		7/19/86		Cl	V		CS2		
174		Ponds	8106	89	Soil	LLF-2s com.		7/19/86	pp			P			Th
175		Ponds	8106	90	Soil	LLF-2s 10'		7/19/86		Cl	V		CS2		
176		Ponds	8106	92	Soil	LLF-2s 20'		7/19/86		Cl	V		CS2		
177		Ponds	8106	93	Soil		Blank	7/19/86		Cl	V		CS2		
178		Ponds	8106	94	Soil		Blank	7/19/86	pp			P			Th
179		Ponds	8106	95	Soil	LLF-3s com		7/19/86	pp			P			Th
180		Ponds	8106	96	Soil	LLF-3s 10'		7/19/86		Cl	V		CS2		
181		Ponds	8106	97	Soil	LLF-3s 20'		7/19/86		Cl	V		CS2		
182		Ponds	8106	98	Soil	LLF-4s com.		7/19/86	pp			P			Th
183		Ponds	8106	99	Soil	LLF-4s 10'		7/19/86		Cl	V		CS2		
184		Ponds	8106	100	Soil	LLF-4s 20'		7/19/86		Cl	V		CS2		
185	Batch 12	Ponds	8108	1	Soil	LLF-5s com.		7/19/86	pp			P			Th
186		Ponds	8108	2	Soil	LLF-5s 10'		7/19/86		Cl	V		CS2		
187		Ponds	8108	3	Soil	LLF-5s 20'		7/19/86		Cl	V		CS2		
188		Ponds	8108	4	Soil	LLF-5s 30'		7/19/86		Cl	V		CS2		
189		Ponds	8108	5	Soil	LLF-6s com.		7/19/86	pp			P			Th
190		Ponds	8108	6	Soil	LLF-6s 10'		7/19/86		Cl	V		CS2		
191		Ponds	8108	7	Soil	LLF-6s 20'		7/19/86		Cl	V		CS2		
192		Ponds	8108	8	Soil	LLF-6s 30'		7/19/86		Cl	V		CS2		
193		Ponds	8108	10	Soil	LLF-7s com.		7/19/86	pp			P			Th
194		Ponds	8108	11	Soil	LLF-7s 10'		7/19/86		Cl	V		CS2		
195		Ponds	8108	12	Soil	LLF-7s 20'		7/19/86		Cl	V		CS2		
196		Ponds	8108	13	Soil	LLF-7s 30'		7/19/86		Cl	V		CS2		
197		Ponds	8108	14	Soil	LLF-8s com.		7/19/86	pp			P			Th
198		Ponds	8108	15	Soil	LLF-8s 10'		7/19/86		Cl	V		CS2		
199		Ponds	8108	16	Soil	LLF-8s 20'		7/19/86		Cl	V		CS2		
200	Batch 13	Ponds	8108	17	Soil	OCTC-1s com.		7/25/86	pp						

Th(Thiocarbamates),OP(Organophosphates),CTC(Carbon Tetrachloride),pp((Priority Pollutants)

3 10 00193

3 10 00194

Sample Send out to Environmental Testing and Certification

	Project	CC/Le	ERC SAMPLE #			Code	Comments	DATE SENT	Analytes						
201		Ponds	8108	18	Soil	OCTC-1s c	Dup	7/25/86	pp						
202		Ponds	8108	19	Soil	OCTC-1s 10'		7/25/86							
203		Ponds	8108	20	Soil	OCTC-1s 1	Dup	7/25/86				CS2	CTC		
204		Ponds	8108	21	Soil	OCTC-1s 20'		7/25/86				CS2	CTC		
205		Ponds	8108	22	Soil	OCTC-1s 30'		7/25/86				CS2	CTC		
206		Ponds	8108	23	Soil	OCTC-1s 40'		7/25/86				CS2	CTC		
207		Ponds	8108	24	Soil	OCTC-1s 50'		7/25/86				CS2	CTC		
208		Ponds	8108	25	Soil		Blank	7/25/86	pp						
209		Ponds	8108	26	Soil		Blank	7/25/86				CS2	CTC		
210		Ponds	8108	27	Soil	OCTC-2s com.		7/25/86	pp						
211		Ponds	8108	28	Soil	OCTC-2s 10'		7/25/86				CS2	CTC		
212		Ponds	8108	29	Soil	OCTC-2s 20'		7/25/86				CS2	CTC		
213		Ponds	8108	31	Soil	OCS-1s comp		7/25/86	pp						
214		Ponds	8108	32	Soil	OCS-1s 10'		7/25/86				CS2	CTC		
215	Batch 14	Ponds	8108	33	Soil	OCS-1s 20'		7/25/86				CS2	CTC		
216		Ponds	8108	34	Soil	OCS-1s 30'		7/25/86				CS2	CTC		
217		Ponds	8108	35	Soil	OCS-1s 40'		7/25/86				CS2	CTC		
218		Ponds	8108	36	Soil	OCS-1s 50'		7/25/86				CS2	CTC		
219		Ponds	8108	37	Soil	OCS-2s com.		7/25/86	pp						
220		Ponds	8108	38	Soil	OCS-2s co	Dup	7/25/86	pp						
221		Ponds	8108	39	Soil	OCS-2s 10'		7/25/86				CS2	CTC		
222		Ponds	8108	40	Soil	OCS-2s 10	Dup	7/25/86				CS2	CTC		
223		Ponds	8108	41	Soil	OCS-2s 20'		7/25/86				CS2	CTC		
224		Ponds	8108	42	Soil	OCS-2s 30'		7/25/86				CS2	CTC		
225		Ponds	8108	43	Soil	OCS-2s 40'		7/25/86				CS2	CTC		
226		Ponds	8108	44	Soil	OCS-2s 50'		7/25/86				CS2	CTC		
227		Ponds	8108	45	Soil		Blank	7/25/86	pp						
228		Ponds	8108	46	Soil		Blank	7/25/86				CS2	CTC		
229	Batch 15	Ponds	8108	47	Soil	NLF-2S com		8/2/86	pp	V					
230		Ponds	8108	48	Soil	NLF-2S co	DUP	8/2/86	pp	V					
231		Ponds	8108	49	Soil	NLF-2S 10'		8/2/86			P			Th	OP
232		Ponds	8108	50	Soil	NLF-2S 10	DUP	8/2/86			P			Th	OP
233		Ponds	8108	51	Soil	NLF-2S 20'		8/2/86			P			Th	OP
234		Ponds	8108	52	Soil	NLF-1S com		8/2/86	pp	V					
235		Ponds	8108	53	Soil	NLF-1S 10'		8/2/86			P			Th	OP
236		Ponds	8108	54	Soil	NLF-1S 20'		8/2/86			P			Th	OP
237		Ponds	8108	55	Soil	NLF-1S 30'		8/2/86			P			Th	OP
238		Ponds	8108	56	Soil	NLF-1S 40'		8/2/86			P			Th	OP
239		Ponds	8108	57	Soil	NLF-1S 50'		8/2/86			P			Th	OP
240		Ponds	8108	58	Soil		BLANK	8/2/86	pp	V					
241		Ponds	8108	59	Soil		BLANK	8/2/86			P			Th	OP
242		Ponds	8108	60	Soil	SLF-1S com		8/2/86	pp	V					
243	Batch 16	Ponds	8108	61	Soil	SLF-1S 10'		8/2/86			P			Th	OP
244		Ponds	8108	62	Soil	SLF-1S 20'		8/2/86			P			Th	OP
245		Ponds	8108	63	Soil	SLF-1S 30'		8/2/86			P			Th	OP
246		Ponds	8108	64	Soil	SLF-1S 40'		8/2/86			P			Th	OP
247		Ponds	8108	65	Soil	SLF-1S 50'		8/2/86			P			Th	OP
248		Ponds	8108	66	Soil	SLF-2S com		8/2/86	pp	V					
249		Ponds	8108	67	Soil	SLF-2S co	DUP	8/2/86	pp	V					
250		Ponds	8108	68	Soil	SLF-2S 10'		8/2/86			P			Th	OP

Th(Thiocarbamates),OP(Organophosphates),CTC(Carbon Tetrachloride),pp((Priority Pollutants)

Sample Send out to Environmental Testing and Certification

	Project	CC/Le	ERC SAMPLE #			Code	Comments	DATE SENT		Analytes			
251		Ponds	8108	69	Soil	SLF-2S 10	DUP	8/2/86			P	Th	OP
252		Ponds	8108	70	Soil	SLF-2S 20'		8/2/86			P	Th	OP
253		Ponds	8108	71	Soil		BLANK	8/2/86	pp	V			
254		Ponds	8108	72	Soil		BLANK	8/2/86			P	Th	OP
255		Ponds	8108	73	Soil	CCLP-2S com		8/2/86	pp				
256		Ponds	8108	74	Soil	CCLP-2S 10'		8/2/86				Th	
257	Batch 17	Ponds	8108	75	Soil	CCLP-2S 1	DUP	8/2/86				Th	
258		Ponds	8108	76	Soil	CCLP-2S c	DUP	8/2/86	pp				
259		Ponds	8108	77	Soil	CCLP-2S 20'		8/2/86				Th	
260		Ponds	8108	78	Soil	CCLP-2S 30'		8/2/86				Th	
261		Ponds	8108	79	Soil	CCLP-2S 40'		8/2/86				Th	
262		Ponds	8108	80	Soil	CCLP-2S 50'		8/2/86				Th	
263		Ponds	8108	81	Soil	CCLP-1S com		8/2/86	pp				
264		Ponds	8108	82	Soil	CCLP-1S 10'		8/2/86				Th	
265		Ponds	8108	83	Soil	CCLP-1S 20'		8/2/86				Th	
266		Ponds	8108	84	Soil	CCLP-1S 30'		8/2/86				Th	
267		Ponds	8108	85	Soil	CCLP-1S 40'		8/2/86				Th	
268		Ponds	8108	86	Soil	CCLP-1S 50'		8/2/86				Th	
269		Ponds	8108	87	Soil		BLANK	8/2/86	pp				
270		Ponds	8108	88	Soil		BLANK	8/2/86				Th	
271	Batch 18	Ponds	8108	89	Soil	CCAP-1S com		8/6/86	pp				
272		Ponds	8108	90	Soil	CCAP-1S c	DUP	8/6/86	pp				
273		Ponds	8108	91	Soil	CCAP-1S 10'		8/6/86				Th	
274		Ponds	8108	92	Soil	CCAP-1S 1	DUP	8/6/86				Th	
275		Ponds	8108	93	Soil	CCAP-1S 20'		8/6/86				Th	
276		Ponds	8108	94	Soil	CCAP-1S 30'		8/6/86				Th	
277		Ponds	8108	95	Soil	CCAP-1S 40'		8/6/86				Th	
278		Ponds	8108	96	Soil	CCAP-1S 50'		8/6/86				Th	
279		Ponds	8108	97	Soil		BLANK	8/6/86	pp				
280		Ponds	8108	98	Soil		BLANK	8/6/86				Th	
281		Ponds	8110	1	Soil	CCAP-2S com		8/6/86	pp				
282	Batch 19	Ponds	8110	2	Soil	CCAP-2S 10'		8/6/86				Th	
283		Ponds	8110	3	Soil	CCAP-2S 20'		8/6/86				Th	
284		Ponds	8110	4	Soil	CCAP-2S 30'		8/6/86				Th	
285		Ponds	8110	5	Soil	CCAP-2S 40'		8/6/86				Th	
286		Ponds	8110	6	Soil	CCAP-2S 50'		8/6/86				Th	
287		Ponds	8110	7	Soil	HTP-2S com		8/6/86	pp				
288		Ponds	8110	8	Soil	HTP-2S co	DUP	8/6/86	pp				
289		Ponds	8110	9	Soil	HTP-2s 10'		8/6/86		SCN			
290		Ponds	8110	10	Soil	HTP-2s 10	DUP	8/6/86		SCN			
291		Ponds	8110	11	Soil	HTP-2S 20'		8/6/86		SCN			
292		Ponds	8110	12	Soil	HTP-2S 30'		8/6/86		SCN			
293		Ponds	8110	13	Soil	HTP-2S 40'		8/6/86		SCN			
294		Ponds	8110	14	Soil		BLANK	8/6/86	pp				
295		Ponds	8110	15	Soil		BLANK	8/6/86		SCN			
296	Batch 20	Ponds	8110	16	Soil	HTP-1S com		8/6/86	pp				
297		Ponds	8110	17	Soil	HTP-1S 10'		8/6/86		SCN			
298		Ponds	8110	19	Soil	HTP-3S com		8/6/86	pp				
299		Ponds	8110	20	Soil	HTP-3S co	DUP	8/6/86	pp				
300		Ponds	8110	21	Soil	HTP-3S 10'		8/6/86		SCN			

Th(Thiocarbamates),OP(Organophosphates),CTC(Carbon Tetrachlor pp((Priority Pollutants)

3 10 00195

Sample Send out to Environmental ..ating and Certification

	Project	CC/Le	ERC SAMPLE #			Code	Comments	DATE SENT	Analytes
301		Ponds	8110	22	Soil	HTP-3S 10	DUP	8/6/86	SCN
302		Ponds	8110	23	Soil	HTP-3S 20'		8/6/86	SCN
303		Ponds	8110	24	Soil	HTP-3S 30'		8/6/86	SCN
304		Ponds	8110	25	Soil	HTP-3S 40'		8/6/86	SCN
305	Batch 21	Swamp	9282-	1	Fish	BA #1		8/12/86	Hg
306		Swamp	9282-	2	Fish	BA #1	DUP	8/12/86	Hg
307		Swamp	9282-	3	Fish	BA #2		8/12/86	Hg
308		Swamp	9282-	4	Fish	BA #3		8/12/86	Hg
309		Swamp	9282-	5	Fish	BA #4		8/12/86	Hg
310		Swamp	9282-	6	Fish	BA #5		8/12/86	Hg
311		Swamp	9282-	7	Fish		BLANK	8/12/86	Hg

Th(Thiocarbamates),OP(Organophosphates),CTC(Carbon Tetrachloride),pp((Priority Pollutants)

3 10 00195

APPENDIX II
TOTAL PRIORITY POLLUTANT RESULTS

D27M

CC/LeMoyne ., Swamp Phase I results, Samples collected 5/13/86 - 5/20/86, Samples analyzed at Environme. .esting and Certification

.a

Sample I.D. :	Detect.	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105
' ription :	Limit	22	23	24	25	26	27	28	31	34	18	21	20	19
	Conc.	LB-4B	LB-1B	LB-2B	LB-3B	CCB-1B	CCB-1B Duplicate	CCB-2B	CCB-3B	blank	SW-01-1S	SW-01-1W	SW-11-1S	SW-11-1W
Compound	(ug/kg or L)	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Water	Soil	Water
Volatile Compounds														
Acrolein	13000	ND, < 500	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 100.0
Acrylonitrile	13000	ND, < 500	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 100.0
Benzene	550	ND, < 22	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 4.4
bis(Chloromethyl)ether	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
Bromoform	590	ND, < 24	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 4.7
Carbon Tetrachloride	350	ND, < 14	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 2.8
Chlorobenzene	750	ND, < 30	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 6.0
Chlorodibromomethane	390	ND, < 16	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 3.1
Chloroethane	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
2-Chloroethylvinyl ether	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
Chloroform	200	ND, < 8	ND	BMDL	ND	ND	ND	ND	ND	BMDL	-	-	ND	ND, < 1.6
Dichlorobromomethane	280	ND, < 11	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 2.2
Dichlorodifluoromethane	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
1,1-Dichloroethane	590	ND, < 24	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 4.7
1,2-Dichloroethane	350	ND, < 14	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 2.8
1,1-Dichloroethylene	350	ND, < 14	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 2.8
1,2-Dichloropropane	750	ND, < 30	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 6.0
cis-1,3-Dichloropropylene	630	ND, < 25	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 5.0
Ethylbenzene	900	ND, < 36	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 7.2
Methyl bromide	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
Methyl chloride	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
Methylene chloride	350	25.9	ND	BMDL	ND	ND	ND	BMDL	ND	BMDL	-	-	ND	ND, < 2.8
1,1,2,2-Tetrachloroethylene	860	ND, < 35	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 6.9
Tetrachloroethylene	510	ND, < 21	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 4.1
Toluene	750	ND, < 30	ND	BMDL	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 6.0
1,2-Trans-dichloroethylene	200	ND, < 8	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 1.6
1,1,1-Trichloroethane	480	ND, < 19	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 3.8
1,1,2-Trichloroethane	630	ND, < 25	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 5.0
Trichloroethylene	240	ND, < 10	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 1.9
Trichlorofluoromethane	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
Vinyl chloride	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
trans-1,3-Dichloropropylene	1300	ND, < 50	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND, < 10.0
Base/Neutrals & Pesticides														
Acenaphthene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Acenaphthylene	5700	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Anthracene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Benzidine	71000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Benzo(a)anthracene	13000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Benzo(a)pyrene	4100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Benzo(b)fluoranthene	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Benzo(ghi)perylene	6700	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
'enzo(k)fluoranthene	5700	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
bis(.aloroethoxy)methane	8600	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
bis(2-Chloroethyl)ether	9300	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
bis(2-Chloroisopropyl)ether	9300	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-

3 10 00198

Cc/Le. . RI/FS, Swamp Phase 1 results, Samples collected 5/13/86 - 5/20/86, Samples analyzed at Envi. .ntal Testing and Certification

3 10 00199

Sample I.D. :	Detect.	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105
Description :	Limit	22	23	24	25	26	27	28	31	34	18	21	20	19
	Conc.	LS-4S	LS-1S	LS-2S	LS-3S	CCS-1S	CCS-1S	CCS-2S	CCS-3S	blank	SW-01-1S	SW-01-1W	SW-11-1S	SW-11-1W
	(ug/kg or L)						Duplicate							
Compound		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Water	Soil	Water
bis(2-Ethylhexyl)phthalate	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
4-Bromophenyl phenyl phthalate	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Butyl benzyl phthalate	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
2-Chloronaphthalene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
4-Chlorophenyl phenyl ether	6800	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Chrysene	4100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Dibenzo(a,h)anthracene	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
1,2-Dichlorobenzene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
1,3-Dichlorobenzene	3100	ND	ND	ND	ND	BMDL	ND	ND	ND	ND	-	-	-	-
1,4-Dichlorobenzene	7100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
3,3'-Dichlorobenzidine	27000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Diethyl phthalate	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Dimethyl phthalate	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Di-n-butyl phthalate	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
2,4-Dinitrotoluene	9300	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
2,6-Dinitrotoluene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Di-n-octyl phthalate	160000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
1,2-Diphenylhydrazine	160000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Fluoranthene	3600	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Fluorene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Hexachlorobenzene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Hexachlorobutadiene	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
H..achlorocyclopentadiene	160000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Hexachloroethane	26000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Indeno(1,2,3-c,d)pyrene	7600	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Isophorone	3600	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Naphthalene	2600	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Nitrobenzene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
N-Nitrosodimethylamine	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
N-Nitrosodi-n-propylamine	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
N-Nitrosodiphenylamine	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Phenanthrene	8800	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Pyrene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
1,2,4-Trichlorobenzene	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Aldrin	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Alpha-BHC	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Beta-BHC	7100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Gamma-BHC	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Delta-BHC	5000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Chlordane	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
4,4'-DDT	4500	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
4,4'-DDE	9100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
4,4'-DDD	7600	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Dieldrin	4100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Endosulfan I	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Endosulfan II	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Endosulfan sulfate	9100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Endrin	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Endrin aldehyde	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Heptachlor	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-

CC/LeMoyne RI/FS, Swamp Phase I results, Samples collected 5/13/86 - 5/20/86, Samples analysed at Environmental Testing and Certification

Sample I.D. :	Detect.	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105
Description :	Limit	22	23	24	25	26	27	28	31	34	18	21	20	19
	Conc.	LO-1B	LO-1B	LO-2B	LO-3B	CCB-1B	CCB-1B	CCB-2B	CCB-3B	blank	SW-01-1B	SW-01-1W	SW-11-1B	SW-11-1W
	(ug/kg or L)						Duplicate							
Compound		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Water	Soil	Water
Heptachlor epoxide	3600	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
PCB-1242	58000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
PCB-1254	58000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
PCB-1221	58000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
PCB-1232	58000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
PCB-1248	58000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
PCB-1260	58000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
PCB-1016	58000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Toxaphene	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Acids														
2-Chlorophenol	5300	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
2,4-Dichlorophenol	4400	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
2,4-Dimethylphenol	4400	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
4,6-Dinitro-o-cresol	39000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
2,4-Dinitrophenol	58000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
2-Nitrophenol	5000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
4-Nitrophenol	3900	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
p-Chloro-m-cresol	4900	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Pentachlorophenol	5000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Phenol	2100	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
2,4,6-Trichlorophenol	4400	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Metals & Cyanide														
Antimony	Variable	ND, < 24000	ND, < 24000	ND, < 24000	ND, < 32000	ND, < 32000	ND, < 32000	ND, < 32000	ND, < 32000	ND, < 32000	ND, < 24000	ND, < 190	-	-
Arsenic	Variable	BMDL 1000	ND, < 1000	ND, < 1000	2000	5000	9000	5000	5000	ND, < 1000	5000	ND, < 10	-	-
Beryllium	Variable	650	400	110	710	460	500	310	810	ND, < 31	530	ND, < .57	-	-
Cadmium	Variable	ND, < 570	ND, < 570	ND, < 570	ND, < 850	ND, < 850	ND, < 850	ND, < 850	ND, < 850	ND, < 850	ND, < 570	ND, < 6.3	-	-
Chromium	Variable	50000 50ppm	19000	6200	24000	130000	110000	140000	180000	ND, < 2400	88000	ND, < 19	-	-
Copper	Variable	8300	6400	1900	10000	35000	31000	14000	34000	BMDL, < 730	68000	BMDL, < 18	-	-
Lead	Variable	12000	15000	BMDL, < 11000	23000	31000	39000	BMDL, < 14000	26000	ND, < 14000	100000	ND, < 58	-	-
Mercury	Variable	280	110	150	220	300000 300ppm	140000	190000	230000	BMDL, < 100	900	0.20	-	-
Nickel	Variable	3500	2100	BMDL, < 1400	5600	51000	48000	32000	56000	ND, < 1900	5500	BMDL, < 11	-	-
Selenium	Variable	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 3000	ND, < 3000	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 10	-	-
Silver	Variable	ND, < 1600	ND, < 1600	ND, < 1600	ND, < 1200	ND, < 1200	ND, < 1200	ND, < 1200	ND, < 1200	ND, < 1200	ND, < 1600	BMDL, < 0.4	-	-
Thallium	Variable	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 500	ND, < 10	-	-
Zinc	Variable	55000	12000	20000	131000	171000	171000	312000	561000	8800	180000	310	-	-
Cyanide, Total	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-

Cold Creek/LeMoyne RI/FS, Well Samples (Source) ; Analysis by Environmental Testing and Certification

3 10 00201

Sample I.D. : Descrption : Compound	Approximate Detection Limit Concentration (ug/l)	8105 1 SCC-CC-12	8105 2 SCC-017-1W	8105 3 SCC-05-1W	8105 4 SCC-050	8105 5 SCC-014	8105 6 SCC-018	8105 7 SCC-016
Volatile Compounds								
Acrolein	100	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	100	ND	ND	ND	ND	ND	ND	ND
Benzene	4.4	ND	ND	ND	ND	ND	ND	ND
bis(Chloromethyl)ether	10	ND	ND	ND	ND	ND	ND	ND
Bromoform	4.7	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	2.8	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	6.0	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	3.1	ND	ND	ND	ND	ND	ND	ND
Chloroethane	10	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl ether	10	ND	ND	ND	ND	ND	ND	ND
Chloroform	1.6	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	2.2	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	10	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	4.7	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	2.8	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	2.8	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	6.0	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropylene	5.0	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	7.2	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	10	ND	ND	ND	ND	ND	ND	ND
Methyl chloride	10	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	2.8	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethylene	6.9	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	4.1	ND	ND	ND	ND	ND	ND	ND
Toluene	6.0	ND	ND	ND	ND	ND	ND	ND
1,2-Trans-dichloroethylene	1.6	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	3.8	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	5.0	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	1.9	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	10	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	10	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropylene	10	ND	ND	ND	ND	ND	ND	ND
Base/Neutrals & Pesticides								
Acenaphthene	2.2	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	4.0	ND	ND	ND	ND	ND	ND	ND
Anthracene	2.2	ND	ND	ND	ND	ND	ND	ND
Benzidine	51.0	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	9.0	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	2.9	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	11.0	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	4.7	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	4.0	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	6.1	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	6.6	ND	ND	ND	ND	ND	ND	ND

ND, Not Detected   BMDL, Detected below method detection limit

3 10 00202

Cold Creek/LeMoyne RI/FS, Well Samples (Source) ; Analysis by Environmental Testing and Certification

Sample I.D. :	Approximate	8105	8105	8105	8105	8105	8105	8105
Description :	Detection	1	2	3	4	5	6	7
	Limit	SCC-CC-12	SCC-017-1W	SCC-05-1W	SCC-050	SCC-014	SCC-018	SCC-016
Compound	Concentration (ug/l)							
Endrin aldehyde	11.0	ND	ND	ND	ND	ND	ND	ND
Heptachlor	2.2	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	2.5	ND	ND	ND	ND	ND	ND	ND
PCB-1242	41.0	ND	ND	ND	ND	ND	ND	ND
PCB-1254	41.0	ND	ND	ND	ND	ND	ND	ND
PCB-1221	41.0	ND	ND	ND	ND	ND	ND	ND
PCB-1232	41.0	ND	ND	ND	ND	ND	ND	ND
PCB-1248	41.0	ND	ND	ND	ND	ND	ND	ND
PCB-1260	41.0	ND	ND	ND	ND	ND	ND	ND
PCB-1016	41.0	ND	ND	ND	ND	ND	ND	ND
Toxaphene	11.0	ND	ND	ND	ND	ND	ND	ND
Acids								
2-Chlorophenol	3.8	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	3.1	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	3.1	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	28.0	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	48.0	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	4.1	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	2.8	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	3.4	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	4.1	ND	ND	ND	ND	ND	ND	ND
Phenol	1.7	5.9	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	3.1	ND	ND	ND	ND	ND	ND	ND
Metals & Cyanide								
Antimony	Variable	ND,<190	ND,<190	ND,<190	ND,<190	ND,<190	ND,<190	ND,<190
Arsenic	Variable	ND,<10	ND,<10	BMDL,<10	ND,<10	ND,<10	11.0	ND,<10
Beryllium	Variable	ND,<.57	ND,<.57	ND,<.57	ND,<.57	ND,<.57	ND,<.57	ND,<.57
Cadmium	Variable	ND,<4.3	ND,<4.3	ND,<4.3	BMDL,<4.3	ND,<4.3	ND,<4.3	ND,<4.3
Chromium	Variable	ND,<19	ND,<19	ND,<19	ND,<19	ND,<19	BMDL,<19	ND,<19
Copper	Variable	BMDL,<18	ND,<18	ND,<18	22.0	ND,<18	ND,<18	BMDL,<18
Lead	Variable	BMDL,<58	ND,<58	ND,<58	BMDL,<58	ND,<58	ND,<58	ND,<58
Mercury	Variable	BMDL,<.2	BMDL,<.2	ND,<.2	ND,<.2	ND,<.2	BMDL,<.2	ND,<.2
Nickel	Variable	16.0	BMDL,<11	BMDL,<11	BMDL,<11	14.0	13.0	BMDL,<11
Selenium	Variable	ND,<5	ND,<5	ND,<5	BMDL,<5	ND,<5	ND,<5	ND,<5
Silver	Variable	BMDL,<8.4	BMDL,<8.4	ND,<8.4	BMDL,<8.4	ND,<8.4	ND,<8.4	BMDL,<8.4
Thallium	Variable	ND,<5	ND,<5	ND,<5	BMDL,<5	ND,<5	ND,<5	BMDL,<5
Zinc	Variable	63.0	36.0	170.0	52.0	110.0	56.0	100.0
Cyanide, Total	25	ND	ND	ND	ND	ND	ND	ND

3 10 00203

Sample I.D. :	Approximate	8105	8105	8105	8105	8105	8105	8105
Descrption :	Detection	1	2	3	4	5	6	7
	Limit	SCC-CC-12	SCC-017-1W	SCC-05-1W	SCC-050	SCC-014	SCC-018	SCC-016
	Concentration							
Compound	(ug/l)							
bis(2-Chloroisopropyl)ether	6.6	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	11.0	ND	ND	ND	BMDL	BMDL	14.1	BMDL
4-Bromophenyl phenyl phthalate	2.2	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	11.0	ND	ND	ND	ND	ND	BMDL	ND
2-Chloronaphthalene	2.2	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	4.8	ND	ND	ND	ND	ND	ND	ND
Chrysene	2.9	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	11.0	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	2.2	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	2.2	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	5.1	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	19.0	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	11.0	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate	11.0	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	11.0	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	6.6	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	2.2	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	11.0	ND	ND	ND	BMDL	BMDL	BMDL	BMDL
1,2-Diphenylhydrazine	11.0	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	2.5	ND	ND	ND	ND	ND	ND	ND
Fluorene	2.2	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	2.2	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	1.0	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	11.0	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	1.8	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,c)pyrene	5.4	ND	ND	ND	ND	ND	ND	ND
Isophorone	2.5	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1.8	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	2.2	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	11.0	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	11.0	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	2.2	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	6.2	ND	ND	ND	ND	ND	ND	ND
Pyrene	2.2	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	2.2	ND	ND	ND	ND	ND	ND	ND
Aldrin	2.2	ND	ND	ND	ND	ND	ND	ND
Alpha-BHC	11.0	ND	ND	ND	ND	ND	ND	ND
Beta-BHC	5.1	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	11.0	ND	ND	ND	ND	ND	ND	ND
Delta-BHC	3.6	ND	ND	ND	ND	ND	ND	ND
Chlordane	11.0	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	3.2	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	6.4	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	5.4	ND	ND	ND	ND	ND	ND	ND
Dieldrin	2.9	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	11.0	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	11.0	ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	6.4	ND	ND	ND	ND	ND	ND	ND
Endrin	11.0	ND	ND	ND	ND	ND	ND	ND

ND, Not Detected BMDL, Detected below method detection limit

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample I.D. :		8105	8105	8105	8105	8105	8105	8105	8105
Description :	Detection Limit Concentration (ug/l)	8 CCM-7-1	9 CCM-7-1 dup 8	11 CCM-7-1 blank	13 NH-1	14 NH-2	15 NCTC	16 LLP	17 CCLP
Compound									
Volatile Compounds									
Acrolein	100	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	100	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	4.4	ND	ND	ND	ND	ND	ND	ND	ND
bis(Chloromethyl)ether	10	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	4.7	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	2.8	ND	ND	ND	199	ND	32.3	ND	5.57
Chlorobenzene	6.0	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	3.1	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	10	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl ether	10	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	1.6	ND	ND	ND	51.5	9.04	ND	ND	ND
Dichlorobromomethane	2.2	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	10	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	4.7	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	2.8	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	2.8	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	6.0	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropylene	5.0	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	7.2	ND	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	10	ND	ND	ND	ND	ND	ND	ND	ND
Methyl chloride	10	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	2.8	ND	ND	588	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethylene	6.9	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	4.1	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	6.0	BMDL	ND	BMDL	ND	8.47	ND	ND	ND
1,2-Trans-dichloroethylene	1.6	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	3.8	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	5.0	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	10	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	10	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropylene	10	ND	ND	ND	ND	ND	ND	ND	ND
Base/Neutrals & Pesticides									
Acenaphthene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	3.5	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	44	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	7.8	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	2.5	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	11	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	4.1	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	3.5	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	5.3	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	5.7	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	5.7	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	10	ND	ND	ND	BMDL	BMDL	ND	ND	BMDL

ND, Not Detected   BMDL, Detected, but below stated EPA method detection limit

3 10 00205

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample I.D. :		8105	8105	8105	8105	8105	8105	8105	8105
escrption :	Detection	8	9	11	13	14	15	16	17
	Limit	CCN-7-1	CCN-7-1	CCN-7-1	NM-1	NM-2	MCTC	LLP	CCLP
	Concentration		dup 8	blank					
Compound	(ug/l)								
4-Bromophenyl phenyl phthalate	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	10	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	4.2	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	2.5	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	10	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	4.4	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	17	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	10	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate	10	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	10	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	5.7	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	10	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenylhydrazine	10	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	2.2	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	.9	ND	ND	ND	ND	ND	ND	ND	ND
chlorocyclopentadiene	10	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	1.6	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,c)pyrene	4.7	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	2.2	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1.6	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	10	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	10	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	5.4	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Aldrin	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Alpha-BHC	10	ND	ND	ND	ND	ND	ND	ND	ND
Beta-BHC	4.4	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	10	ND	ND	ND	ND	ND	ND	ND	ND
Delta-BHC	3.1	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane	10	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	2.8	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	5.6	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	4.7	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	2.5	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	10	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	10	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	5.6	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	10	ND	ND	ND	ND	ND	ND	ND	ND
Endrin aldehyde	10	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	2.2	ND	ND	ND	ND	ND	ND	ND	ND

ND, Not Detected BMDL, Detected, but below stated EPA method detection limit

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample I.D. : / Description : / Compound	Detection Limit Concentration (ug/l)	8105 8 CCH-7-1	8105 9 CCH-7-1 dup 8	8105 11 CCH-7-1 blank	8105 13 MH-1	8105 14 MH-2	8105 15 MCTC	8105 16 LLP	8105 17 CCLP
PCB-1242	36	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	36	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	36	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	36	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	36	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	36	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1016	36	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	10	ND	ND	ND	ND	ND	ND	ND	ND
Acids									
2-Chlorophenol	3.3	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	2.7	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	2.7	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	24	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	42	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	3.6	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	2.4	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	3.0	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	3.6	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	1.5	ND	ND	ND	ND	ND	7.52	ND	ND
2,4,6-Trichlorophenol	2.7	ND	ND	ND	ND	ND	ND	ND	ND
Metals & Cyanide									
Antimony	190	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	20	30	26	ND,<10	ND	ND	ND,<50	ND,<50	BMDL
Beryllium	1	ND,<.57	ND,<.57	ND,<.57	ND	ND	ND	ND	ND
Cadmium	4	ND	BMDL	ND	BMDL	ND	ND	ND	ND
Chromium	20	BMDL	ND	ND	ND	ND	ND	ND	ND
Copper	10	BMDL,<10	ND,<10	ND,<10	ND	ND	ND	ND	BMDL
Lead	50	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	ND	ND	ND	ND	ND	0.30	0.80	BMDL
Nickel	20	24	BMDL,<11	ND,<11	33	ND	BMDL	22	13
Selenium	5	ND	ND	ND	ND	ND	ND,<25	BMDL	ND
Silver	8	ND	BMDL	ND	ND	ND	ND	ND	ND
Thallium	5	ND	ND,<25	ND	ND	ND	ND,<25	ND,<25	ND
Zinc	20	120	40	16	50	22	12	23	160
Cyanide, Total	25	ND	ND	ND	*MISSING	ND	ND	132	ND

*Bottle broke in shipment

ND, Not Detected   BMDL, Detected, but below stated EPA method detection limit

3 10 00207

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample I.D. :		8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106
Descrption :	Detection	27	35	42	43	44	52	55	61	67	74	76	77
	Limit	APP-1S	APP-2S		APP-2S	MTP-1S	MTP-2S	MCTC-1S	MCTC-2S	LLP-1S		LLP-2S	LLP-2S
	Concentration	split EPA		blank	dup 35						blank		dup 76
Compound	(ug/kg)												
Volatile Compounds													
Acrolein	25000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	25000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(Chloromethyl)ether	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	780	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl ether	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	550	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropylene	1300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl chloride	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	700	ND	ND	ND	ND	ND	ND	3060	2990	3140	ND	6320	ND
1,1,2,2-Tetrachloroethylene	1700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans-dichloroethylene	400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	950	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	1300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	480	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropylene	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Base/Neutrals & Pesticides													
Acenaphthene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	3500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	44000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	7700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	5900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	4100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	3500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	5200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	5600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	5600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND, Not Detected   BMDL, Detected, but below stated EPA method detection limit

3 10 00208

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample I.D. : / Descrption : / Compound	Detection Limit Concentration (ug/kg)	8106 27 APP-1S split EPA	8106 35 APP-2S	8106 42 blank	8106 43 APP-2S dup 35	8106 44 HTP-1S	8106 52 HTP-2S	8106 55 HCTC-1S	8106 61 HCTC-2S	8106 67 LLP-1S	8106 74 blank	8106 76 LLP-2S	8106 77 LLP-2S dup 76
4-Bromophenyl phenyl phthalate	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	4200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	4400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	5600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenylhydrazine	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	2200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	890	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
exachlorocyclopentadiene	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	4700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	2200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	5300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aldrin	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha-BHC	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Beta-BHC	4400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Delta-BHC	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	2800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	5500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	4700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	5500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin aldehyde	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	2200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND, Not Detected   BMDL, Detected, but below stated EPA method detection limit

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample I.D. :		8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106
Description :	Detection	27	35	42	43	44	52	55	61	67	74	76	77
	Limit	APP-1S	APP-2S		APP-2S	HTP-1S	HTP-2S	MCTC-1S	MCTC-2S	LLP-1S		LLP-2S	LLP-2S
	Concentration	split EPA		blank	dup 35						blank		dup 76
Compound	(ug/kg)												
PCB-1242	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1016	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acids													
2-Chlorophenol	3300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	2700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	2700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	24000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	42000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	3600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	2400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	3000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	3600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	2700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals & Cyanide													
Antimony	12000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	1000	1000	2000	ND	1000	BMDL	BMDL	4000	BMDL	BMDL	ND	BMDL	BMDL
Beryllium	42	200	160	ND	160	43	BMDL,<76	130	150	81	ND	150	270
Cadmium	420	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	1300	12000	11000	BMDL	8900	4500	8600	29000	100000	6500	ND	8400	12000
Copper	1000	4200	3800	BMDL	3700	2300	3300	4000	4600	2200	ND	2700	3700
Lead	4600	7200	7600	ND	7900	4900	5000	5000	BMDL	5400	BMDL	6100	6900
Mercury	100	BMDL	BMDL	ND	ND	1400	24000	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL
Nickel	720	1200	1200	BMDL	1300	BMDL	1600	1800	8200	1700	BMDL	2500	2500
Selenium	500	BMDL	BMDL	ND	ND	ND	BMDL	BMDL	BMDL	ND	BMDL	BMDL	ND
Silver	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	500	500	BMDL	ND	ND	ND	BMDL	BMDL	ND	BMDL	ND	BMDL	BMDL
Zinc	600	14000	8400	5700	9100	9700	12000	15000	21000	10000	1500	11000	12000
Cyanide, Total	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	1900	ND	ND

3 10 00210

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample I.D. : Descrption : Compound	Detection Limit Concentration (ug/kg)	8106 83 LLP-1S	8106 86 LLP-1S dup 83	8106 89 LLP-2S	8106 94 blank	8106 95 LLP-3S	8106 98 LLP-4S	8108 1 LLP-5S	8108 5 LLP-6S	8108 10 LLP-7S	8108 14 LLP-8S
Volatile Compounds											
Acrolein	25000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	25000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(Chloromethyl)ether	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	780	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl ether	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	550	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropylene	1300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl chloride	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	700	nd	ND	BMDL	BMDL	BMDL	970	BMDL	743	3520	ND
1,1,2,2-Tetrachloroethylene	1700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	1500	ND	ND	ND	ND	ND	ND	ND	ND	5460	ND
1,2-Trans-dichloroethylene	400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	950	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	1300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	480	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropylene	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Base/Neutrals & Pesticides											
Acenaphthene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	3500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	44000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	7700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	4100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	3500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
s(2-Chloroethoxy)methane	5200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	5600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	5600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND, Not Detected   BMDL, Detected, but below stated EPA method detection limit

3 10 00211

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample I.D. :		8106	8106	8106	8106	8106	8106	8108	8108	8108	8108
Description :	Detection Limit Concentration (ug/kg)	83 LLP-1S	86 LLP-1S dup 83	89 LLP-2S	94 blank	95 LLP-3S	98 LLP-4S	1 LLP-5S	5 LLP-6S	10 LLP-7S	14 LLP-8S
Compound											
4-Bromophenyl phenyl phthalate	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	4200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	4400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	16000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	5600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenylhydrazine	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	2200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	390	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
achlorocyclopentadiene	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,c)pyrene	4700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	2200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	5300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aldrin	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha-BHC	9900	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND
Beta-BHC	4400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Delta-BHC	3100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	2800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	5500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	4700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	5500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin aldehyde	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	1900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	2200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND, Not Detected   BMDL, Detected, but below stated EPA method detection limit

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

3 10 00212

Sample I.D. :		8106	8106	8106	8106	8106	8106	8108	8108	8108	8108
Description :	Detection	83	86	89	94	95	98	1	5	10	14
	Limit	LLP-1S	LLP-1S	LLP-2S		LLP-3S	LLP-4S	LLP-5S	LLP-6S	LLP-7S	LLP-8S
	Concentration		dup 83		blank						
Compound	(ug/kg)										
PCB-1242	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1016	36000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	9900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acids											
2-Chlorophenol	3300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	2700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	2700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	24000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	42000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	3600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	2400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	3000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	3600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	2700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals & Cyanide											
Antimony	12000	24000	28000	7500	ND	23000	33000	16000	11000	BMDL	8600
Arsenic	1000	ND	ND	BMDL	ND	ND	BMDL	1000	BMDL	ND	BMDL
Beryllium	42	BMDL	58	BMDL	ND	240	55	BMDL	BMDL	ND	BMDL
Cadmium	420	ND	ND	ND	BMDL	BMDL	ND	ND	ND	ND	BMDL
Chromium	1300	46000	51000	5300	BMDL	15000	22000	7800	7100	3800	5200
Copper	1000	48000	61000	7200	15000	23000	35000	25000	19000	15000	32000
Lead	4600	6000	4500	BMDL	BMDL	BMDL	ND	BMDL	BMDL	BMDL	BMDL
Mercury	100	100	100	BMDL	ND	100	ND	BMDL	1900	100	ND
Nickel	720	2800	4900	1300	BMDL	3800	3900	1600	4100	BMDL	1900
Selenium	500	BMDL	BMDL	500	ND	BMDL	ND	ND	BMDL	500	ND
Silver	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	500	BMDL	ND	BMDL	ND	ND	ND	ND	ND	ND	ND
Zinc	600	12000	14000	6800	3600	19000	22000	7100	14000	4400	8100
Cyanide, Total	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thiocarbamates	(mg/kg)										
EPTC (Eptam)	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butylate (Sutan)	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vernolate (Vernam)	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pebulate (Tillam)	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molinate (Ordram)	1	BMDL	ND	BMDL	ND	ND	ND	ND	ND	ND	ND
Cycloate (Ro-Neet)	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Miscellaneous	(mg/kg)										
Phosphorus	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND, Not Detected   BMDL, Detected, but below stated EPA method detection limit

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Compound	Detection Limit Concentration (ug/kg)	8100 17 OCTC-10	8100 18 OCTC-10 dup	8100 25 blank	8100 27 OCTC-20	8100 31 OCB-10	8100 37 OCB-20	8100 38 OCB-20 dup	8100 45 blank	8100 47 BLP-20	8100 48 BLP-20 Dup	8100 52 BLP-10	8100 54 Blank	8100 60 BLP-10	8100 66 BLP-20	8100 67 BLP-20 Dup	8100 71 Blank	8100 73 CCLP-20	8100 76 CCLP-20 Dup	8100 81 CCLP-10	8100 87 Blank
Volatile Compounds																					
Acrolein	25000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	25000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(Chloromethyl)ether	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl ether	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	550	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropylene	1300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl chloride	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	700	BMDL	1900	ND	ND	BMDL	BMDL	BMDL	1100	ND	ND	ND	ND	BMDL	BMDL	BMDL	ND	1300	1100	ND	ND
1,1,2,2-Tetrachloroethylene	1700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans-dichloroethylene	600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	950	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	1300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropylene	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Base/Neutrals & Pesticides																					
Acenaphthene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	370	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	4700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	830	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	430	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	370	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	560	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	600	ND	ND	ND	ND	ND	ND	ND	ND	[illegible]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	1100	BMDL	ND	BMDL	BMDL	ND	ND	ND	ND		BMDL	1590	1660	ND	BMDL	BMDL	2030	ND	BMDL	BMDL	2370

3 10 00214

Cold Cr[illegible] Hoyne 81/90; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/5/86; Analysis by Environmental Testing and Certification

Compound	Detection Limit Concentration (ug/kg)	8100 17 OCTC-18	8100 18 OCTC-18 dup	8100 25 blank	8100 27 OCTC-28	8100 31 OCB-18	8100 37 OCB-28	8100 38 OCB-28 dup	8100 45 blank	8100 47 BLP-28	8100 48 BLP-28 Dup	8100 52 BLP-18	8100 58 Blank	8100 60 BLP-18	8100 66 BLP-28	8100 67 BLP-28 Dup	8100 71 Blank	8100 73 CCLP-28	8100 76 CCLP-28 Dup	8100 81 CCLP-18	8100 87 Blank
4-Bromophenyl phenyl phthalate	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	450	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	470	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	1700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	1100	BMDL	ND	383	BMDL	BMDL	BMDL	BMDL	BMDL	ND	ND	ND	ND	BMDL	ND	ND	BMDL	ND	ND	ND	ND
2,4-Dinitrotoluene	600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	1100	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenylhydrazine	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	230	325	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	570	ND	ND	ND	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	200	263	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aldrin	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha-BHC	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Beta-BHC	470	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Delta-BHC	330	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	550	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin aldehyde	550	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

3 10 00215

[illegible] a/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental [illegible] Certification

Sample I.D. :		0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100	0100
Description :	Detection	17	18	25	27	31	37	38	46	47	48	52	58	60	66	67	71	73	76	81	87
	Limit	OCTC-1S	OCTC-1S		OCTC-2S	OCB-1S	OCB-2S	OCB-2S		SLP-2S	SLP-2S	SLP-1S		SLP-1S	SLP-2S	SLP-2S		CCLP-2S	CCLP-2S	CCLP-1S	
	Concentration		dup	blank				dup	blank		Dup		Blank			Dup	Blank		Dup		Blank
Compound	(ug/kg)																				
PCB-1242	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	3000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	3000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	3000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	3000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1016	3000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acids																					
2-Chlorophenol	330	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	2400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	4200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	240	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	150	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals & Cyanide																					
Antimony	12000	9700	5600	ND	31000	33000	33000	30000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	1000	ND	ND	ND	1000	7000	ND	5000	BMDL	1000	1000	BMDL	BMDL	1000	3000	2000	ND	2000	2000	1000	ND
Beryllium	42	BMDL	ND	ND	70	90	110	130	ND	140	150	170	BMDL	210	650	760	ND	300	240	450	BMDL
Cadmium	420	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	1300	5200	5300	BMDL	15000	10000	16000	13000	BMDL	14000	10000	8500	ND	15000	31000	30000	ND	10000	9200	15000	BMDL
Copper	1000	10000	6400	3900	3400	15000	10000	9700	6900	2900	3000	2500	BMDL	4500	7700	8700	ND	5400	2900	5000	BMDL
Lead	4600	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	BMDL	4600	BMDL	ND	ND	BMDL	BMDL	BMDL	BMDL
Mercury	100	BMDL	BMDL	ND	300	400	BMDL	ND	ND	600	600	BMDL	ND	BMDL	BMDL	BMDL	ND	BMDL	ND	BMDL	BMDL
Nickel	720	1200	1300	BMDL	2300	2500	8400	9000	ND	1000	1500	1400	BMDL	2100	3600	7100	BMDL	3700	1900	3600	BMDL
Selenium	500	ND	ND	ND	BMDL	ND	ND	ND	ND	BMDL	BMDL	ND	ND	500	800	500	ND	BMDL	ND	BMDL	ND
Silver	1600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	500	600	ND	ND	ND	ND	BMDL	ND	ND	BMDL	BMDL	ND	ND	BMDL	BMDL	BMDL	ND	BMDL	BMDL	BMDL	ND
Zinc	600	6100	5700	5900	11000	15000	20000	23000	1300	9600	11000	8800	3300	15000	23000	42400	2800	15000	10000	21000	3900
Cyanide, Total	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Miscellaneous																					
Vanadium	1600	-	-	-	-	-	-	-	-	20000	22000	8300	ND	25000	19000	54000	ND	-	-	-	-

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certil......ion

ple I.D. :		8106	8106	8106	8110	8110	8110	8110	8110	8110	8110
escrption :	Detection	89	90	97	1	7	8	14	16	19	20
	Limit	CCAP-1S	CCAP-1S		CCAP-2S	BTP-2S	BTP-2S		BTP-1S	BTP-3S	BTP-3S
	Concentration		Dup	Blank			Dup	Blank			Dup
Compound	(ug/kg)										
Volatile Compounds											
Acrolein	25000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	25000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(Chloromethyl)ether	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl ether	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	550	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropylene	1300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl chloride	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	700	ND	ND	BMDL	ND	ND	BMDL	BMDL	BMDL	BMDL	860
1,1,2,2-Tetrachloroethylene	1700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans-dichloroethylene	800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	950	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	1300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	400	ND	ND	ND	ND	ND	ND	776	ND	ND	ND
Trichlorofluoromethane	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropylene	2500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Base/Neutrals & Pesticides											
Acenaphthene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	370	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine	4700	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	830	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	430	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	370	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(-Chloroethoxy)methane	560	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether	600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether	600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	1100	BMDL	BMDL	ND	ND	BMDL	ND	ND	BMDL	ND	BMDL

3 10 00216

3 10 00217

Cold Creek/LeMoyne RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

ple I.D. :		8108	8108	8108	8110	8110	8110	8110	8110	8110	8110
escription :	Detection	89	90	91	1	7	8	14	16	19	20
	Limit	CCAP-1S	CCAP-1S		CCAP-2S	HTP-2S	HTP-2S		HTP-1S	HTP-3S	HTP-3S
	Concentration		Dup	Blank			Dup	Blank			Dup
Compound	(ug/kg)										
4-Bromophenyl phenyl phthalate	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether	450	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	410	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	1700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	BMDL
1,2-Diphenylhydrazine	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	510	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aldrin	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha-BHC	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Beta-BHC	470	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Delta-BHC	330	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4' DDD	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	590	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin aldehyde	590	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
hlor epoxide	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	

Cold Creek/...pe RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and ...cation

Sample I.D. :		0100	0100	0100	0110	0110	0110	0110	0110	0110	0110
description :	Detection Limit Concentration (ug/kg)	89 CCAP-1S	90 CCAP-1S Dup	97 Blank	1 CCAP-2S	7 HTP-2S	8 HTP-2S Dup	14 Blank	16 HTP-1S	19 HTP-3S	20 HTP-3S Dup
Compound											
PCB-1242	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	3800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	3800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	3800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	3800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1016	3800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acids											
2-Chlorophenol	330	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-o-cresol	2400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	4200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	240	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chloro-m-cresol	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	150	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	270	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals & Cyanide											
Antimony	12000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	1000	2000	2000	ND	1000	1000	BMDL	ND	2000	1000	1000
Beryllium	42	100	77	BMDL	120	520	390	ND	110	450	570
Cadmium	420	ND	ND	ND	ND	ND	ND	ND	1600	ND	ND
Chromium	1300	9500	7400	BMDL	7400	16000	11000	ND	43000	14000	15000
Copper	1000	3800	2000	ND	2300	5100	4600	BMDL	442000	4300	4800
Lead	4600	ND	BMDL	BMDL	BMDL	BMDL	4400	BMDL	22000	BMDL	BMDL
Mercury	100	ND	ND	ND	ND	BMDL	BMDL	ND	900	BMDL	BMDL
Nickel	720	1600	1200	BMDL	1600	6300	4100	ND	10000	3300	3600
Selenium	500	ND	BMDL	ND	BMDL	ND	ND	ND	ND	BMDL	BMDL
Silver	1600	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND
Thallium	500	BMDL	ND	ND	ND	ND	ND	ND	BMDL	ND	ND
Zinc	600	7300	8600	2200	5300	37000	27000	3400	1170000	23000	27000
Cyanide, Total	500	1000	ND	ND	ND	ND	ND	ND	240000	ND	ND

3 10 00218

APPENDIX III
SITE SPECIFIC ANALYTE RESULTS

3 10 00220

Cold Creek/LeMoyne RI/FS; Phase I Swamp; Sampled 5/1/86 to 5/20/86; Analysis by Environmental Testing and Certification

Sample I.D. : Description :		8105 22 LB-4B	8106 23 LB-1B	8106 24 LB-2B	8105 25 LB-3B	8105 26 CCB-1B	8106 27 CCB-1B Duplicate	8106 28 CCB-2B	8105 31 CCB-3B	8106 34 blank	8106 18 MW-01-1B	8105 21 MW-01-1W
Compound		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Water
Thiocarbamates	Conc. (mg/kg)											
EPTC (Eptam)	0.10	ND	ND	ND	ND	0.10	BMDL	0.20	1.00	ND	-	-
Butylate (Sutan)	0.10	ND	ND	ND	ND	ND	ND	0.30	1.00	ND	-	-
Vernolate (Vernam)	0.10	ND	ND	ND	ND	ND	ND	0.20	1.10	ND	-	-
Pebulate (Tillam)	0.10	ND	ND	ND	ND	ND	ND	ND	0.30	ND	-	-
Molinate (Ordram)	0.10	ND	ND	ND	ND	0.10	BMDL	0.40	0.90	ND	-	-
Cycloate (Ro-Neet)	0.10	ND	0.20	ND	ND	ND	BMDL	0.50	1.00	ND	-	-
Miscellaneous	Conc. (mg/kg or L)											
Chloride	50	50.00	190.00	ND	100.00	ND	ND	50.00	60.00	ND	-	-
Mercury	(ug/kg or L) Variable	280	110	150	220	300000	140000	190000	230000	BMDL, (100	900	0.20

Code	CCB-2-1E	CCB-2-1W	CCB-3-1W	CCB-3-1E	CCB-4-1E	CCB-4-2E	CCB-4-3E	CCB-4-3W	CCB-4-2W	CCB-4-1W	CCB-5-2W
Mercury found (mg/kg) (Detection Limit 0.1 mg/kg)	1.8	7.3	690	29	58	1.2	2.0	BMDL	0.14	15.0	12.7

Code	CCB-5-1W	CCB-5-2E	CCB-5-1E	CCB-6-1E	CCB-6-1W	CCB-6-1W Dup	CCB-6-2W	CCB-7-3W	CCB-7-2W	CCB-7-1W	CCB-7-1E
Mercury found (mg/kg) (Detection Limit 0.1 mg/kg)	9.30	5.3	1.8	4.9	6.0	6.8	5.6	0.9	22.0	7.7	103

Code	CCB-7-2E	blank	CCB-7-3E	CCB-7-4E	CCB-7-5E	CCB-7-6E	CCB-8-1W	CCB-8-1E	CCB-8-2E	CCB-8-3E	CCB-8-4E
Mercury found (mg/kg) (Detection Limit 0.1 mg/kg)	35.0	BMDL	49.0	25.0	10.5	17.0	2.1	0.3	2.2	1.7	7.0

Code	BA 1	BA 1 Dup	BA 2	BA 3	BA 4	BA 5	Blank
Mercury found (mg/kg) (Detection Limit 0.1 mg/kg)	0.59	0.67	3.10	0.91	1.10	0.42	ND

3 10 00221

Cold Creek/LeMoyne RI/FS; Source Wells; Sampled 5/1/86 to 5/23/86; Analysis by Environmental Testing and Certification

Compound	Detection Limit Concentration (ug/l)																				
Sample I.D. :		8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105	8105
		93	95	92	82	83	85	86	90	91	79	76	77	78	81	80	8	9	11	13	14
Description :		0-23	0-29	0-31	0-32	0-28	0-39	0-39	0-41	0-45	0-49	0-58	0-64	0-65	0-73	CCN-4	CCN-7-1	CCN-7-1	CCN-7-1	MW-1	MW-2
		split CNM	CNM bl.	split CNM			dup 83'	blank										Dup	Blank		
Thiocarbamates																					
EPTC (Eptam)	1	4.9	ND	5.6	9.7	6.1	5.1	ND	5.1	13	2.3	BMDL	4	ND	6.1	1.3	17	19	ND	BMDL	BMDL
Butylate (Sutan)	1	2.2	ND	2.5	3	2.2	2.3	ND	2.2	10	BMDL	ND	1.2	ND	1.4	2.7	13	14	ND	ND	ND
Vernolate (Vernam)	1	6.5	ND	2.8	2.6	3.5	2.9	ND	2.9	0.7	1	ND	2.1	ND	1.0	4.6	3.8	4	ND	ND	ND
Pebulate (Tillam)	1	1.9	ND	BMDL	ND	BMDL	BMDL	ND	BMDL	1	ND	ND	BMDL	ND	BMDL	BMDL	BMDL	BMDL	ND	ND	ND
Molinate (Ordram)	1	8.8	ND	8	10	9.4	7.6	ND	7.1	17	4.2	3	10	BMDL	7.3	231	24	25	ND	BMDL	ND
Cycloate (Ro-Neet)	1	2.6	ND	2.1	2.9	2.6	1.9	ND	2.2	7.1	BMDL	BMDL	1.8	ND	1.9	3.9	3.9	4.1	ND	ND	ND
Organophosphates																					
Fonos (Dyfonate)	1	BMDL	ND	ND	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbophenothion (Trithion)	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phosmet (Imidan)	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bensulide (Betasan)	1	BMDL	ND,<10	ND,<10	ND,<10	BMDL,<10	ND,<10	ND,<10	ND,<10	ND,<10	ND	ND	BMDL	ND	ND,<10	1	BMDL	BMDL	ND	ND	ND
Miscellaneous	Concentration (ug/l)																				
[illegible] disulfide	.2	22200	.406	35600	ND,<.06	ND	ND,<6	ND	ND	368	ND	ND,<.06	.244	.234	ND	.252	0.526	0.35	0.44	ND	ND
Carbon tetrachloride	.2	230000	ND,<.4	42400	1.41	864	1310	ND	812	1520	ND	1.06	1.12	1.18	1.98	ND	ND	ND	ND	250	ND
Mercury	.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Concentration (mg/l)																				
Chloride	1	390	-	110.9	35.2	59.8	60.8	ND	36.3	129.0	367.0	64.2	61.5	160.2	150.3	233	82.6	101	ND	332	22.1
Thiocyanate	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	-	-
Phosphorus		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfite		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfide		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

3 10 00222

Cold C....,LeMoyne RI/FS; Field Blank Results for Site Specific Parameters ; Analysis by Environmental Testing and Co... .tion

Sample I.D. :		8100	8100	8100	8100	8100	8100	8100	8110	8110	8110	8110	8110	8100	8100	8100	8100	8100	8100	8100	8100	8100	8100
		91	92	93	94	95	96	98	2	3	4	5	6	82	83	84	85	86	88	74	75	77	78
Location		CCAP-1S	CCAP-1S	CCAP-1S	CCAP-1S	CCAP-1S	CCAP-1S		CCAP-2S	CCAP-2S	CCAP-2S	CCAP-2S	CCAP-2S	CCLP-1S	CCLP-1S	CCLP-1S	CCLP-1S	CCLP-1S		CCLP-2S	CCLP-2S	CCLP-2S	CCLP-2S
Depth in feet		10'	10'	20'	30'	40'	50'	Blank	10'	20'	30'	40'	50'	10'	20'	30'	40'	50'	Blank	10'	10'	20'	30'
			Dup																		Dup		
Compound	Detection Limit																						
Thiocarbamates	Conc. (ug/kg)																						
EPTC (Eptam)	0.1	0.3	0.2	25	1.2	0.9	ND	ND	ND	1.6	BMDL	0.2	ND	ND	ND	ND	ND	ND	ND	0.1	BMDL	BMDL	ND
Butylate (Sutan)	0.1	0.1	0.1	0.3	0.1	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	BMDL	BMDL	ND
Vernolate (Vernam)	0.1	0.1	0.1	0.6	0.3	0.3	ND	ND	ND	1.1	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	0.1	BMDL	BMDL	ND
Pebulate (Tillam)	0.1	0.1	ND	1.2	0.2	0.2	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	0.1	0.2	ND
Molinate (Ordram)	0.1	0.3	0.2	6.4	5	3.7	ND	ND	ND	0.8	0.2	0.2	ND	ND	ND	ND	ND	ND	ND	0.1	BMDL	0.1	ND
Cycloate (Ro-Neet)	0.1	0.2	0.1	2.7	0.1	0.5	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	0.1	BMDL	ND
Organophosphates																							
Fonofos (Dyfonate)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion (Trithion)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosmet (Imidan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bensulide (Betasan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	Conc. (ug/kg)																						
Carbon disulfide	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	16000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Conc. (ug/kg)																						
Chloride	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thiocyanate	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfite	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfide	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

3 10 00223

Cold Creek/LeMoyne B…onds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certific…

Sampl. #:		8108 79	8108 80	8110 17	8110 21	8110 22	8110 23	8110 24	8110 25	8110 9	8110 10	8110 11	8110 12	8110 13	8110 15	8106 45	8106 46	8106 47	8106 53	8106 54	8106 56	8106 57	8106 58
Location		CCLP-23	CCLP-23	HTP-13	HTP-38	HTP-38	HTP-38	HTP-38	HTP-38	HTP-23	HTP-23	HTP-23	HTP-23	HTP-23		HTP-13	HTP-13	HTP-13	HTP-23	HTP-23	HCTC-13	HCTC-13	HCTC-13
Depth in feet		40'	50'	10'	10'	10' Dup	20'	30'	40'	10'	10' Dup	20'	30'	40'	Blank	10'	20'	30'	10'	20'	10'	20'	30'
Compound	Detection Limit																						
Thiocarbamates	Conc. (mg/kg)																						
EPTC (Eptam)	0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylate (Sutan)	0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vernolate (Vernam)	0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pebulate (Tillam)	0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molinate (Ordram)	0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cycloate (Ro-Neet)	0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organophosphates																							
Fonofos (Dyfonate)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion (Trithion)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosmet (Imidan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bensulide (Betasan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	Conc. (mg/kg)																						
Carbon disulfide	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND
Carbon tetrachloride	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND
Mercury	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	16000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Conc. (mg/kg)																						
Chloride	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	650	1200	600	ND	ND	-	-	-
Thiocyanate	10	-	-	1010	2400	2560	1030	420	190	550	520	640	20	ND	ND	-	-	-	-	-	-	-	-
Phosphorus		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfite	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfide	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Cold Creek/LaMoyne B.   onds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certificati.

Sampl).:		8106 59	8106 60	8106 62	8106 63	8106 64	8106 65	8106 66	8108 19	8108 20	8108 21	8108 22	8108 23	8108 24	8108 26	8108 28	8108 29	8108 32	8108 33	8108 34	8108 35	8108 36	8108 39
Location		MCTC-18	MCTC-18	MCTC-23	MCTC-23	MCTC-23	MCTC-23	MCTC-23	OCTC-18	OCTC-18	OCTC-18	OCTC-18	OCTC-18	OCTC-18	OCTC-23	OCTC-23	OCTC-23	OC8-18	OC8-18	OC8-18	OC8-18	OC8-18	OC8-23
Depth in feet		40'	50'	10'	20'	30'	40'	50'	10'	10' Dup	20'	30'	40'	50'	blank	10'	20'	10'	20'	30'	40'	50'	10'
Compound	Detection Limit																						
Thiocarbamates	Conc. (mg/kg)																						
EPTC (Eptam)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylate (Sutan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vernolate (Vernam)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pebulate (Tillam)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molinate (Ordram)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cycloate (Ro-Neet)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organophosphates																							
Fonofos (Dyfonate)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion (Trithion)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosmet (Imidan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bensulide (Betasan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	Conc. (ug/kg)																						
Carbon disulfide	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	15.0	ND	2.28	ND	0.83	ND.<10	2.08	ND
Carbon tetrachloride	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.06	1.51	ND	ND	ND	ND	ND	ND	3.02	2.79	685
Mercury	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	16000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Conc. (mg/kg)																						
Chloride	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thiocyanate	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfite	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfide	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

3 10 00224

3 10 00225

Old Creek/LeMoyne RI/FS; , Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certification

Sample No.:		0100	0100	0100	0100	0100	0100	0106	0106	0106	0106	0106	0106	0106	0106	0106	0106	0106	0106	0106	0106	0106	0106
		40	41	42	43	44	46	28	29	30	31	32	36	37	38	39	40	41	42	68	69	70	71
Location		OCS-2S	OCS-2S	OCS-2S	OCS-2S	OCS-2S	OCS-2S	APP-1S	APP-1S	APP-1S	APP-1S	APP-1S	APP-2S	APP-2S	APP-2S	APP-2S	APP-2S	APP-2S		LLP-1S	LLP-1S	LLP-1S	LLP-1S
Depth in feet		10'	20'	30'	40'	50'	Blank	10'	20'	30'	40'	50'	10'	20'	20'	30'	40'	50'	Blank	10'	10'	20'	30'
		Dup													Dup						Dup		
Compound	Detection Limit																						
Thiocarbamates	Conc. (ug/kg)																						
EPTC (Eptam)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylate (Sutan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vernolate (Vernam)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pebulate (Tillam)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molinate (Ordram)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cycloate (Ro-Neet)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organophosphates																							
Fonofos (Dyfonate)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion (Trithion)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosmet (Imidan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bensulide (Betasan)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	Conc. (ug/kg)																						
Carbon disulfide	0.2	ND	2.55	5.16	4.78	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	0.2	60.4	6.64	7.74	3.48	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	16000	-	-	-	-	-	-	25500000	4270000	10100000	2910000	1700000	24500000	11100000	9160000	6540000	5700000	1800000	100000	-	-	-	-
	Conc. (mg/kg)																						
Chloride	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND
Thiocyanate	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	150	-	-	-	-	-	-	ND	ND	ND	210	570	ND	ND	ND	ND	200	500	ND	-	-	-	-
Sulfite	100	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-
Sulfide	5	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-

Cold Creek/LeMoyne .; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certific

Sample No.:		8106	8106	8106	8106	8106	8106	8106	8106	8105	8105	8105	8108	8108	8108	8108	8108	8108	8108	8108	8106	8108	8108
		72	73	78	79	80	81	82	75	15	16	17	53	54	55	56	57	58	49	50	51	61	62
Location		LLP-1S	LLP-1S	LLP-2S	LLP-2S	LLP-2S	LLP-2S	LLP-2S	LLP-2S	MCTC	LLP	CCLP	MLP-1S	MLP-1S	MLP-1S	MLP-1S	MLP-1S		MLP-2S	MLP-2S	MLP-2S	SLP-1S	SLP-1S
Depth in feet		40'	50'	10'	20'	30'	40'	50'	blank				10'	20'	30'	40'	50'	Blank	10'	10' Dup	20'	10'	20'
Compound	Detection Limit																						
Thiocarbamates	Conc. (mg/kg)																						
EPTC (Eptam)	0.1	-	-	-	-	-	-	-	-	-	-	-	BMDL	BMDL	BMDL	BMDL	ND	ND	0.9	0.3	ND	ND	ND
Butylate (Sutan)	0.1	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.1	ND	BMDL	ND	BMDL	BMDL	ND	ND	ND
Vernolate (Vernam)	0.1	-	-	-	-	-	-	-	-	-	-	-	BMDL	BMDL	BMDL	ND	ND	ND	0.1	BMDL	ND	ND	ND
Pebulate (Tillam)	0.1	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	BMDL	BMDL	ND	ND	ND
Molinate (Ordram)	0.1	-	-	-	-	-	-	-	-	-	-	-	BMDL	BMDL	0.2	0.3	0.4	ND	1.5	0.6	ND	ND	ND
Cycloate (Ro-Neet)	0.1	-	-	-	-	-	-	-	-	-	-	-	BMDL	ND	BMDL	ND	BMDL	ND	0.1	BMDL	ND	ND	ND
Organophosphates																							
Fonofos (Dyfonate)	0.1	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbophenothion (Trithion)	0.1	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phosmet (Imidan)	0.1	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bensulide (Betasan)	0.1	-	-	-	-	-	-	-	-	-	-	-	ND	0.5	ND	0.1	ND	ND	ND	ND	ND	ND	ND
Miscellaneous	Conc. (mg/kg)																						
Carbon disulfide	0.2	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	0.2	-	-	-	-	-	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	16000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Conc. (mg/kg)																						
Chloride	50	65	ND	ND	50	ND	ND	200	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thiocyanate	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus		-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfate	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfite	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfide	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

3 10 00226

Cold Creek/LeMoyne Rl, Ponds, Lagoons, and Landfills, Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testing and Certificatic

Sampl . :		8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106	8106
		63	64	65	68	69	70	72	84	85	88	90	92	93	96	97	99	100	2	3	4	6	7
Location		SLP-1S	SLP-1S	SLP-1S	SLP-2S	SLP-2S	SLP-2S		LLP-1S	LLP-1S	LLP-1S	LLP-2S	LLP-2S	LLP-2S	LLP-3S	LLP-3S	LLP-4S	LLP-4S	LLP-5S	LLP-5S	LLP-5S	LLP-6S	LLP-6S
Depth in feet		30'	40'	50'	10'	10'	20'	Blank	10'	10'	20'	10'	20'	blank	10'	20'	10'	20'	10'	20'	30'	10'	20'
						Dup				Dup													
Compound	Detection Limit																						
Thiocarbamates	Conc. (mg/kg)																						
EPTC (Eptam)	0.1	ND	BMDL	ND	BMDL	ND	BMDL	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylate (Sutan)	0.1	ND	ND	ND	BMDL	ND	BMDL	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vernolate (Vernam)	0.1	ND	ND	ND	BMDL	ND	BMDL	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pebulate (Tillam)	0.1	ND	ND	ND	ND	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molinate (Ordram)	0.1	ND	ND	ND	BMDL	BMDL	0.1	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cycloate (Ro-Neet)	0.1	ND	ND	ND	BMDL	ND	BMDL	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organophosphates																							
Fonofos (Dyfonate)	0.1	ND	ND	ND	ND	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion (Trithion)	0.1	ND	ND	ND	ND	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosmet (Imidan)	0.1	ND	ND	ND	ND	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bensulide (Betasan)	0.1	ND	ND	ND	ND	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	Conc. (mg/kg)																						
Carbon disulfide	0.2	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	1100	-	-	-	-	-	-	-	10000	6300	1600	30000	1300	BMDL	9700	4000	24000	4900	3600	3300	1900	6100	5700
Iron	16000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Conc. (mg/kg)																						
Chloride	50	-	-	-	-	-	-	-	ND	ND	ND	220	ND	ND	ND	ND	ND	ND	ND	ND	57	ND	ND
Thiocyanate	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus		ND	ND	ND	ND	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfite	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfide	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

... RI/FS; Ponds, Lagoons, and Landfills; Sampled 6/15/86 to 8/6/86; Analysis by Environmental Testi... ...ion

Sample No.:		8100	8100	8100	8100	8100	8100
		8	11	12	13	15	16
Location		LLP-6B	LLP-7B	LLP-7B	LLP-7B	LLP-8B	LLP-8B
Depth in feet		30'	10'	20'	30'	10'	20'
Compound	Detection Limit						
Thiocarbamates	Conc. (mg/kg)						
EPTC (Eptam)	0.1	-	-	-	-	-	-
Butylate (Sutan)	0.1	-	-	-	-	-	-
Vernolate (Vernam)	0.1	-	-	-	-	-	-
Pebulate (Tillam)	0.1	-	-	-	-	-	-
Molinate (Ordram)	0.1	-	-	-	-	-	-
Cycloate (Ro-Neet)	0.1	-	-	-	-	-	-
Organophosphates							
Fonofos (Dyfonate)	0.1	-	-	-	-	-	-
Carbophenothion (Trithion)	0.1	-	-	-	-	-	-
Phosmet (Imidan)	0.1	-	-	-	-	-	-
Bensulide (Betasan)	0.1	-	-	-	-	-	-
Misce[illegible]ous	Conc. (mg/kg)						
Carbon disulfide	0.2	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	0.2	-	-	-	-	-	-
Mercury	0.3	-	-	-	-	-	-
Vanadium	1100	1800	3500	1100	6200	2100	6900
Iron	16000	-	-	-	-	-	-
	Conc. (mg/kg)						
Chloride	50	57	ND	ND	91	ND	ND
Thiocyanate	10	-	-	-	-	-	-
Phosphorus		-	-	-	-	-	-
Sulfate	150	-	-	-	-	-	-
Sulfite	100	-	-	-	-	-	-
Sulfide	5	-	-	-	-	-	-

ND = Not Detected; BMDL: Detected below stated method dete... ... required.

3 10 00228

ld Creek/LeMoyne Rd, .es Wells; Sampled 5/1 - 6/3/86, Analysis by Environmental Testing and certification

Compound	Approximate Detection Limit Concentration (ug/l)	8105 1 SCC-05-1W	8105 69 SCC-08-1W	8105 5 SCC-014	8105 7 SCC-016	8105 2 SCC-017-1	8105 6 SCC-018	8105 64 SCC-22-1W	8105 65 SCC-23-1W	8105 67 SCC-24-1W	8105 68 SCC-25-1W	8106 4 SCC-060	8106 66 SCC-51-1W	8105 86 SCC-52	8105 87 SCC-70
Thiocarbamates															
EPTC (Eptam)	1.0	ND	1.2	1.4	5.9	ND	ND	ND	ND	ND	1.0	BMDL	ND	ND	BMDL
Butylate (Sutan)	1.0	ND	BMDL	BMDL	1.3	ND	ND	ND	ND	ND	BMDL	BMDL	ND	ND	BMDL
Vernolate (Vernam)	1.0	ND	ND	BMDL	BMDL	ND	ND	ND	ND	ND	BMDL	ND	ND	ND	BMDL
Pebulate (Tillam)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND
Molinate (Ordram)	1.0	ND	1.7	2.2	1.5	ND	ND	ND	ND	ND	BMDL	BMDL	ND	ND	BMDL
Cycloate (Ro-Neet)	1.0	ND	BMDL	BMDL	BMDL	ND	ND	ND	ND	ND	BMDL	ND	ND	ND	BMDL
Organophosphates															
Fonofos (Dyfonate)	1.0	ND	ND	ND	ND	ND	ND	-	-	-	-	ND	-	ND	ND
Carbophenothion (Trithion)	1.0	ND	ND	ND	ND	ND	ND	-	-	-	-	ND	-	ND	ND
Phosmet (Imidan)	1.0	ND	ND	ND	ND	ND	ND	-	-	-	-	ND	-	ND	ND
Bensulide (Betasan)	1.0	ND	ND	ND	ND	ND	BMDL	-	-	-	-	ND	-	ND	ND
Miscellaneous															
Mercury	0.2	ND	-	ND	ND	BMDL	BMDL	ND	ND	-	-	ND	ND	ND,<.3	ND,<.3
Carbon disulfide	0.2	ND,<.2	ND,<.2	BMDL,<.2	BMDL,<.2	BMDL,<.2	BMDL,<.2	ND,<.2	ND,<.2	1.2	ND,<.2	ND,<.2	ND,<.2	ND,<.2	0.2
Carbon tetrachloride	0.2	-	-	-	-	-	-	-	-	-	-	-	-	ND,<.38	ND,<.38
	Conc. in mg/L														
Thiocyanate	0.4	-	-	-	-	-	0.4	-	-	-	ND,<.4	-	-	-	-
Chloride	1.0	9.7	41.3	16.0	26.4	4.0	5.3	123.6	37.8	3000.0	28.8	45.6	3.4	3.7	20.9

3 10 00229

ild Creek/LeMoyne RI/FS, wells; Sampled 5/1 - 6/3/86, Analysis by Environmental Testing and certification

Compound	Approximate Detection Limit Concentration (ug/l)	8105 70 SCC-079	8105 74 SCC-079 blank	8105 71 SCC-080	8106 3 SCCLM-5	8106 4 SCCLM-6	8106 1 SCCLM-7	8106 2 SCCLM-10	8105 1 SCC-CC-12	8106 13 CMA-3	8106 19 CMA-6	8106 17 CMA-7	8106 12 CMA-9	8106 18 CMA-11	8106 16 CMA-13
Thiocarbamates															
EPTC (Eptam)	1.0	ND	ND	ND	57.0	4.7	ND	ND	ND	ND	ND	ND	2.1	ND	ND
Butylate (Sutan)	1.0	ND	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vernolate (Vernam)	1.0	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pebulate (Tillam)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molinate (Ordram)	1.0	ND	ND	ND	5.1	5.4	ND	ND	ND	ND	ND	ND	3.4	ND	ND
Cycloate (Ro-Neet)	1.0	ND	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND
Organophosphates															
Fonofos (Dyfonate)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbophenothion (Trithion)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phosmet (Imidan)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bensulide (Betasan)	1.0	ND	ND	ND	ND,<10	ND,<10	ND,<10	ND,<10	BDL	ND,<10	ND	ND	ND,<10	ND	ND,<10
Miscellaneous															
Mercury	0.2	ND	ND	ND	ND	ND,<.3	ND,<.3	ND	BDL	BDL,<.3	ND,<.3	ND,<.3	ND,<.3	ND,<.3	ND,<.3
Carbon disulfide	0.2	ND,<.2	ND,<.2	ND,<.2	0.8	232.0	ND	ND	ND,<.2	0.3	6.3	ND,<.4	ND,<.1	0.5	ND,<.1
C[illegible]n tetrachloride	0.2	-	-	-	-	-	-	-	-	-	0.8	14.5	-	0.7	-
	Conc. in mg/L														
Thiocyanate	0.4	6.0	ND,<.4	ND,<.4	-	-	-	-	-	-	-	-	-	-	-
Chloride	1.0	16.0	ND	6.8	17.4	50.4	4.7	7.9	3.4	37.9	36.9	5.6	37.4	17.8	65.6

]]a ... ne RI/FS, Area Wells; Sampled 5/1 - 6/3/86, Analysis by Environmental Testing and Certification

Compound	Approximate Detection Limit Concentration (ug/l)	Sample I.D. : 8106 Description : 15 CMA-14	8106 6 CMA-15	8106 20 CMA-16	8106 23 CMA-16 Blank	8106 14 CMA-17	8106 10 CMAM-1	8106 11 CMAM-22	8106 7 CMAM-25	8106 9 CMAM-28	8106 5 CMAM-30
Thiocarbamates											
EPTC (Eptam)	1.0	ND	ND	ND	ND	ND	ND	21.0	ND	ND	7.0
Butylate (Sutan)	1.0	ND	ND	ND	ND	ND	ND	6.0	ND	ND	2.1
Vernolate (Vernam)	1.0	BMDL	ND	ND	ND	ND	ND	7.5	ND	ND	2.0
Pebulate (Tillam)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molinate (Ordram)	1.0	ND	ND	ND	ND	BMDL	ND	26.0	ND	ND	26.0
Cycloate (Ro-Neet)	1.0	ND	ND	ND	ND	ND	ND	5.7	ND	ND	1.3
Organophosphates											
Fonofos (Dyfonate)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbophenothion (Trithion)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phosmet (Imidan)	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bensulide (Betasan)	1.0	ND,<10	ND,<10	ND	ND	ND,<10	ND	ND,<10	ND,<10	ND	ND,<10
Miscellaneous											
Mercury	0.2	BMDL,<.3	ND,<.3	ND,<.3	ND,<.3	ND,<.3	ND,<.3	ND,<.3	ND,<.3	ND,<.3	ND,<.3
Carbon disulfide	0.2	2.4	0.5	ND,<.4	ND,<.4	45.4	0.7	ND,<.1	1.0	ND,<.4	0.6
Carbon tetrachloride	0.2	-	-	ND,<.3	ND,<.3	-	17.6	-	-	7.0	-
	Conc. in mg/L										
Thiocyanate	0.4	-	-	-	-	-	-	-	-	-	-
Chloride	1.0	96.6	11.3	3.0	ND	4.7	23.4	260.0	6.2	21.2	53.7

ND ... BMDL Detected below method detection limit; - Analysis not required

APPENDIX IV
FIELD QUALITY ASSURANCE SPIKE RESULTS

3 10 00233

reek/LeMoyne RI/FS, Priority Pollutant Field Sample Spike and Blank Spike Results ; Analysis by Environ ing and Certification

Sample I.D. : / Description : / Compound	Approximate Detection Limit Concentration (ug/l)	0105 11 CCM-7-1 Blank	0105 8 CCM-7-1	0105 9 CCM-7-1 Dup	Spike Conc.	0105 10 CCM-7-1 Spike Found	0105 10 CCM-7-1 Spike Net	0105 10 CCM-7-1 Spike % Recovery	Spike Conc.	0105 12 CCM-7-1 Blank Spike Found	0105 12 CCM-7-1 Blank Spike % Recovery
Volatile Compounds											
Acrolein	100	ND	ND	ND	-	ND	ND		-	ND	
Acrylonitrile	100	ND	ND	ND	-	ND	ND		-	ND	
Benzene	4.4	ND	ND	ND	-	ND	ND		-	ND	
bis(Chloromethyl)ether	10	ND	ND	ND	-	ND	ND		-	ND	
Bromoform	4.7	ND	ND	ND	-	ND	ND		-	ND	
Carbon Tetrachloride	2.8	ND	ND	ND	21.0	19.4	19.4	92%	21.0	20.2	96%
Chlorobenzene	6.0	ND	ND	ND	21.0	19.6	19.6	93%	21.0	20.8	99%
Chlorodibromomethane	3.1	ND	ND	ND	21.0	18.5	18.5	88%	21.0	18.9	90%
Chloroethane	10	ND	ND	ND	-	ND	ND		-	ND	
2-Chloroethylvinyl ether	10	ND	ND	ND	21.0	ND	ND	0%	21.0	ND	0%
Chloroform	1.6	ND	ND	ND	21.0	21.1	21.1	100%	21.0	21.5	102%
Dichlorobromomethane	2.2	ND	ND	ND	-	ND	ND		-	ND	
Dichlorodifluoromethane	10	ND	ND	ND	-	ND	ND		-	ND	
1,1-Dichloroethane	4.7	ND	ND	ND	21.0	20.1	20.1	96%	21.0	20.9	100%
1,2-Dichloroethane	2.8	ND	ND	ND	-	ND	ND		-	ND	
1,1-Dichloroethylene	2.8	ND	ND	ND	21.0	20.4	20.4	97%	21.0	22.7	108%
1,2-Dichloropropane	6.0	ND	ND	ND	21.0	19.7	19.7	94%	21.0	20.1	96%
cis-1,3-Dichloropropylene	5.0	ND	ND	ND	-	ND	ND		-	ND	
Ethylbenzene	7.2	ND	ND	ND	-	ND	ND		-	ND	
Methyl bromide	10	ND	ND	ND	-	ND	ND		-	ND	
Methyl chloride	10	ND	ND	ND	-	ND	ND		-	ND	
Methylene chloride	2.8	500.0	ND	ND	21.0	19.4	19.4	92%	21.0	736.0	3505%
1,1,2,2-Tetrachloroethylene	6.9	ND	ND	ND	-	ND	ND		-	ND	
Tetrachloroethylene	4.1	ND	ND	ND	21.0	17.9	17.9	85%	21.0	18.7	89%
Toluene	6.0	BMDL	BMDL	ND	-	ND	ND		-	ND	
1,2-Trans-dichloroethylene	1.6	ND	ND	ND	-	ND	ND		-	ND	
1,1,1-Trichloroethane	3.8	ND	ND	ND	-	ND	ND		-	ND	
1,1,2-Trichloroethane	5.0	ND	ND	ND	21.0	19.5	19.5	93%	21.0	19.8	94%
Trichloroethylene	1.9	ND	ND	ND	21.0	17.5	17.5	83%	21.0	18.3	87%
Trichlorofluoromethane	10	ND	ND	ND	-	22.3	22.3		-	25.1	
Vinyl chloride	10	ND	ND	ND	-	ND	ND		-	ND	
trans-1,3-Dichloropropylene	10	ND	ND	ND	-	ND	ND		-	ND	
							Average	85%		Average	a
Base/Neutrals & Pesticides											
Acenaphthene	2.2	ND	ND	ND	124.0	112.0	112.0	90%	124.0	94.1	76%
Acenaphthylene	4.0	ND	ND	ND	-	ND	ND		-	ND	
Anthracene	2.2	ND	ND	ND	-	ND	ND		-	ND	
Benzidine	51.0	ND	ND	ND	-	ND	ND		-	ND	
Benzo(a)anthracene	9.0	ND	ND	ND	-	ND	ND		-	ND	
Benzo(a)pyrene	2.5	ND	ND	ND	105.0	44.0	44.0	42%	105.0	76.7	73%
Benzo(b)fluoranthene	11.0	ND	ND	ND	-	ND	ND		-	ND	
Benzo(ghi)perylene	4.7	ND	ND	ND	101.0	20.2	20.2	20%	101.0	72.3	72%
Benzo(k)fluoranthene	4.0	ND	ND	ND	102.0	66.1	66.1	65%	102.0	101.0	99%
bis(2-Chloroethoxy)methane	6.1	ND	ND	ND	-	ND	ND		-	ND	
bis(2-Chloroethyl)ether	6.6	ND	ND	ND	-	ND	ND		-	ND	

Detected BMDL, Detected below method detection limit

3 10 00234

Sample I.D. : Description : Compound	Approximate Detection Limit Concentration (ug/l)	8105 11 CCN-7-1 Blank	8105 8 CCN-7-1	8105 9 CCN-7-1 Dup	Spike Conc.	8105 10 CCN-7-1 Spike Found	8105 10 CCN-7-1 Spike Net	8105 10 CCN-7-1 Spike % Recovery	Spike Conc.	8105 12 CCN-7-1 Blank Spike Found	8105 12 CCN-7-1 Blank Spike % Recovery
bis(2-Chloroisopropyl)ether	6.6	ND	ND	ND	-	ND	ND		-	ND	
bis(2-Ethylhexyl)phthalate	11.0	ND	ND	ND	-	ND	ND		-	ND	
4-Bromophenyl phenyl phthalate	2.2	ND	ND	ND	-	ND	ND		-	ND	
Butyl benzyl phthalate	11.0	ND	ND	ND	-	ND	ND		-	ND	
2-Chloronaphthalene	2.2	ND	ND	ND	-	ND	ND		-	ND	
4-Chlorophenyl phenyl ether	4.8	ND	ND	ND	-	ND	ND		-	ND	
Chrysene	2.9	ND	ND	ND	-	ND	ND		-	ND	
Dibenzo(a,h)anthracene	11.0	ND	ND	ND	-	ND	ND		-	ND	
1,2-Dichlorobenzene	2.2	ND	ND	ND	-	ND	ND		-	ND	
1,3-Dichlorobenzene	2.2	ND	ND	ND	111.0	80.5	80.5	72%	111.0	67.8	61%
1,4-Dichlorobenzene	5.1	ND	ND	ND	-	ND	ND		-	ND	
3,3'-Dichlorobenzidine	19.0	ND	ND	ND	-	ND	ND		-	ND	
Diethyl phthalate	11.0	ND	ND	ND	-	ND	ND		-	ND	
Dimethyl phthalate	11.0	ND	ND	ND	-	ND	ND		-	ND	
Di-n-butyl phthalate	11.0	ND	ND	ND	-	ND	ND		-	ND	
2,4-Dinitrotoluene	6.6	ND	ND	ND	-	ND	ND		-	ND	
2,6-Dinitrotoluene	2.2	ND	ND	ND	109.0	88.0	88.0	81%	109.0	68.0	62%
Di-n-octyl phthalate	11.0	ND	ND	ND	106.0	44.8	44.8	42%	106.0	76.7	72%
1,2-Diphenylhydrazine	11.0	ND	ND	ND	-	ND	ND		-	ND	
Fluoranthene	6.5	ND	ND	ND	-	ND	ND		-	ND	
Fluorene	2.2	ND	ND	ND	-	ND	ND		-	ND	
Hexachlorobenzene	2.2	ND	ND	ND	-	ND	ND		-	ND	
Hexachlorobutadiene	1.0	ND	ND	ND	-	ND	ND		-	ND	
Hexachlorocyclopentadiene	11.0	ND	ND	ND	111.0	11.0	11.0	10%	111.0	34.3	31%
Hexachloroethane	1.8	ND	ND	ND	111.0	91.3	91.3	82%	111.0	76.8	69%
Indeno(1,2,3-c,d)pyrene	5.4	ND	ND	ND	-	ND	ND		-	ND	
Isophorone	2.5	ND	ND	ND	-	ND	ND		-	ND	
Naphthalene	1.8	ND	ND	ND	116.0	94.2	94.2	81%	116.0	78.7	68%
Nitrobenzene	2.2	ND	ND	ND	-	ND	ND		-	ND	
N-Nitrosodimethylamine	11.0	ND	ND	ND	-	ND	ND		-	ND	
N-Nitrosodi-n-propylamine	11.0	ND	ND	ND	-	ND	ND		-	ND	
N-Nitrosodiphenylamine	2.2	ND	ND	ND	-	ND	ND		-	ND	
Phenanthrene	6.2	ND	ND	ND	-	ND	ND		-	ND	
Pyrene	2.2	ND	ND	ND	-	ND	ND		-	ND	
1,2,4-Trichlorobenzene	2.2	ND	ND	ND	109.0	137.0	137.0	126%	109.0	120.0	110%
Aldrin	2.2	ND	ND	ND	104.0	89.2	89.2	86%	104.0	85.9	83%
Alpha-BHC	11.0	ND	ND	ND	88.0	BMDL	BMDL	0%	88.0	BMDL	0%
Beta-BHC	5.1	ND	ND	ND	-	ND	ND		-	ND	
Gamma-BHC	11.0	ND	ND	ND	110.0	13.6	13.6	12%	110.0	17.1	16%
Delta-BHC	3.6	ND	ND	ND	-	ND	ND		-	ND	
Chlordane	11.0	ND	ND	ND	-	ND	ND		-	ND	
4,4'-DDT	3.2	ND	ND	ND	110.0	64.4	64.4	59%	110.0	69.4	63%
4,4'-DDE	6.4	ND	ND	ND	-	ND	ND		-	ND	
4,4'-DDD	5.4	ND	ND	ND	102.0	61.1	61.1	60%	102.0	66.8	65%
Dieldrin	2.9	ND	ND	ND	108.0	51.4	51.4	48%	108.0	56.9	53%
Endosulfan I	11.0	ND	ND	ND	-	ND	ND		-	ND	
Endosulfan II	11.0	ND	ND	ND	-	ND	ND		-	ND	
Endosulfan sulfate	6.4	ND	ND	ND	104.0	46.5	46.5	45%	104.0	44.9	43%
Endrin	11.0	ND	ND	ND	106.0	63.6	63.6	60%	106.0	53.4	50%

ND Not Detected BMDL Detected below method detection limit

'LeMoyne RI/FS, Priority Pollutant Field Sample Spike and Blank Spike Results ; Analysis by Environmen' and Certification

Sample I.D. : / Description : / Compound	Approximate Detection Limit Concentration (ug/l)	8105 11 CCM-T-1 Blank	8105 8 CCM-T-1	8105 9 CCM-T-1 Dup	Spike Conc.	8105 10 CCM-T-1 Spike Found	8105 10 CCM-T-1 Spike Net	8105 10 CCM-T-1 Spike % Recovery	Spike Conc.	8105 12 CCM-T-1 Blank Spike Found	8105 12 CCM-T-1 Blank Spike % Recovery
Endrin aldehyde	11.0	ND	ND	ND	-	ND	ND		-	ND	
Heptachlor	2.2	ND	ND	ND	107.0	77.2	77.2	72%	107.0	60.0	57%
Heptachlor epoxide	2.5	ND	ND	ND	-	ND	ND		-	ND	
PCB-1242	41.0	ND	ND	ND	-	ND	ND		-	ND	
PCB-1254	41.0	ND	ND	ND	-	ND	ND		-	ND	
PCB-1221	41.0	ND	ND	ND	-	ND	ND		-	ND	
PCB-1232	41.0	ND	ND	ND	-	ND	ND		-	ND	
PCB-1248	41.0	ND	ND	ND	-	ND	ND		-	ND	
PCB-1260	41.0	ND	ND	ND	-	ND	ND		-	ND	
PCB-1016	41.0	ND	ND	ND	-	ND	ND		-	ND	
Toxaphene	11.0	ND	ND	ND	-	ND	ND		-	ND	
								==========			==========
							Average	58%		Average	61%
Acids											
2-Chlorophenol	3.0	ND	ND	ND	106.0	103.0	103.0	97%	106.0	101.0	95%
2,4-Dichlorophenol	3.1	ND	ND	ND	106.0	111.0	111.0	105%	106.0	106.0	100%
2,3-Dimethylphenol	3.1	ND	ND	ND	106.0	41.1	41.1	39%	106.0	87.2	82%
4,6-Dinitro-o-cresol	20.0	ND	ND	ND	526.0	525.0	525.0	100%	526.0	546.0	104%
2,4-Dinitrophenol	40.0	ND	ND	ND	316.0	331.0	331.0	105%	316.0	335.0	106%
2-Nitrophenol	4.1	ND	ND	ND	106.0	90.7	90.7	86%	106.0	92.7	87%
4-Nitrophenol	2.8	ND	ND	ND	526.0	144.0	144.0	27%	526.0	220.0	42%
p-Chloro-m-cresol	3.4	ND	ND	ND	526.0	512.0	512.0	97%	526.0	432.0	82%
Pentachlorophenol	4.1	ND	ND	ND	526.0	424.0	424.0	81%	526.0	441.0	84%
Phenol	1.7	ND	ND	ND	106.0	59.1	59.1	56%	106.0	56.0	53%
2,4,6-Trichlorophenol	3.1	ND	ND	ND	316.0	275.0	275.0	87%	316.0	269.0	85%
								==========			==========
							Average	80%		Average	84%
Metals & Cyanide											
Antimony	Variable	ND,<190	ND,<190	ND,<190	79.0	BMDL,<190	BMDL,<190	-	79.0	BMDL,<190	-
Arsenic	Variable	ND,<10	30.0	26.0	88.0	120.0	102.0	116%	88.0	80.0	91%
Beryllium	Variable	ND,<.57	ND,<.57	ND,<.57	101.0	101.0	101.0	100%	101.0	100.0	99%
Cadmium	Variable	ND,<4.3	ND,<4.3	BMDL,<4.3	95.0	98.0	98.0	103%	95.0	97.0	102%
Chromium	Variable	ND,<19	BMDL,<19	ND,<19	115.0	110.0	110.0	96%	115.0	110.0	96%
Copper	Variable	ND,<18	BMDL,<18	ND,<18	94.0	96.0	96.0	102%	94.0	94.0	100%
Lead	Variable	ND,<58	ND,<58	ND,<58	103.0	BMDL,<58	BMDL,<58	<60%	103.0	BMDL,<58	<60%
Mercury	Variable	ND,<.2	ND,<.2	ND,<.2	106.0	93.0	93.0	88%	106.0	110.0	104%
Nickel	Variable	ND,<11	24.0	BMDL,<11	92.0	100.0	83.0	90%	92.0	97.0	105%
Selenium	Variable	ND,<5	ND,<5	ND,<5	104.0	79.0	79.0	76%	104.0	94.0	90%
Silver	Variable	ND,<8.4	ND,<8.4	BMDL,<8.4	140.0	63.0	63.0	45%	140.0	66.0	47%
Thallium	Variable	ND,<5	ND,<5	ND,<5	133.0	85.0	85.0	64%	133.0	96.0	72%
Zinc	Variable	16.0	120.0	40.0	131.0	170.0	90.0	69%	131.0	150.0	115%
Cyanide, Total	25	ND	ND	ND	478.0	502.0	502.0	105%	478.0	580.0	121%
								==========			==========
							Average	86%		Average	93%

etected BMDL, Detected below method detection limit

3 10 00235

Cold Creek/Lebo,.. RI/FS, Quality Assurance Spike Results; Analysis by Environmental Testing and Certification

Sample I.D. : / Description : / Compound	Approximate Detection Limit Concentration (ug/l)	0105 11 CCM-7-1 Blank	0105 8 CCM-7-1	0105 9 CCM-7-1 Dup	Avg.	Spike Conc.	0105 10 CCM-7-1 Spike Found	0105 10 CCM-7-1 Spike Net	0105 10 CCM-7-1 Spike % Recovery	Spike Conc.	0105 12 CCM-7-1 Blank Spike Found	0105 12 CCM-7-1 Blank Spike % Recovery
Thiocarbamates												
EPTC (Eptam)	1	ND	17.0	19.0	18.0	10.0	33.0	15.0	150%	10.0	8.6	86%
Butylate (Sutan)	1	ND	13.0	14.0	13.5	9.1	26.0	12.5	137%	9.1	9.9	109%
Vernolate (Vernam)	1	ND	3.8	4.0	3.9	15.0	20.0	16.1	107%	15.0	15.0	100%
Pebulate (Tillam)	1	ND	BMDL	BMDL	0.0	11.6	12.0	12.0	103%	11.6	12.0	103%
Molinate (Ordram)	1	ND	24.0	25.0	24.5	9.8	38.0	13.5	138%	9.8	9.7	99%
Cycloate (Ro-Neet)	1	ND	3.9	4.1	4.0	15.4	21.0	17.0	110%	15.4	16.0	104%
Organophosphates												
Fonofos (Dyfonate)	1	ND	ND	ND	0.0	15.5	16.0	16.0	103%	15.5	16.0	103%
Carbophenothion (Trithion)	1	ND	ND	ND	0.0	10.5	9.9	9.9	94%	10.5	15.0	143%
Phosmet (Imidan)	1	ND	ND	ND	0.0	10.7	ND	0.0	0%	10.7	2.1	11%
Bensulide (Betasan)	1	ND	BMDL	BMDL	0.0	15.1	20.0	20.0	132%	15.1	19.0	126%
									===========			===========
								Average	108%		Average	98%
Miscellaneous												
Mercury	0.2	ND	ND	ND		106.0	93.0	93.0	88%	106.0	110.0	104%
Carbon disulfide	0.8	0.4	0.5	0.4		27.0	42.0	42.4	157%	27.0	33.4	124%
Carbon tetrachloride	0.2	ND,<.2	ND,<.2	ND,<.2		34.0	67.0	67.0	197%	34.0	44.0	129%
	Conc. in mg/L											
Thiocyanate	0.4	ND,<.4	-	-		-	-	-	-	120.0	130.0	108%
Chloride	1.0	ND	86.6	101.0		63.0	190.0	105.0	167%	76.0	86.3	114%

3 10 00236

ack/LeMoyne RI/FS, Quality Assurance Spike Results; Analysis by Environmental Testing and .ation

Sample I.D. : / Description : / Compound	Approximate Detection Limit Concentration (ug/l)	0105 T4 SCC-079 blank	0105 T0 SCC-079	0105 T3 SCC-079 dupe T0	Spike Conc.	0105 T2 SCC-079 spike T0 Found	0105 T2 SCC-079 spike T0 Net	0105 T2 SCC-079 spike T0 % Recovery	Spike Conc.	0105 T5 SCC-079 blank spike Found	0105 T5 SCC-079 blank spike % Recovery
Thiocarbamates											
EPTC (Eptam)	1	ND	ND	ND	10.0	8.2	8.2	82%	10.0	8.7	87%
Butylate (Sutan)	1	ND	ND	ND	9.1	9.0	9.0	99%	9.1	9.2	101%
Vernolate (Vernam)	1	ND	ND	ND	15.0	14.0	14.0	93%	15.0	15.0	100%
Pebulate (Tillam)	1	ND	ND	ND	11.6	11.0	11.0	95%	11.6	11.0	95%
Molinate (Ordram)	1	ND	ND	ND	9.8	9.5	9.5	97%	9.8	9.9	101%
Cycloate (Ro-Neet)	1	ND	ND	ND	15.4	16.0	16.0	104%	15.4	17.0	110%
Organophosphates											
Fonofos (Dyfonate)	1	ND	ND	ND	15.5	16.0	16.0	103%	15.5	17.0	110%
Carbophenothion (Trithion)	1	ND	ND	ND	10.5	14.0	14.0	133%	10.5	14.0	133%
Phosmet (Imidan)	1	ND	ND	ND	18.7	2.0	2.0	11%	18.7	3.5	19%
Bensulide (Betasan)	1	ND	ND	ND	15.1	22.0	22.0	146%	15.1	17.0	113%
							Average	96%		Average	97%
Miscellaneous											
Mercury	0.2	ND	ND	ND	105.0	70.0	70.0	67%	105.0	80.0	76%
Carbon disulfide	0.8	ND,<.2	ND,<.2	ND,<.2	27.0	38.0	38.8	141%	27.0	33.0	122%
Carbon tetrachloride	0.2	-	-	-	-	-	-		-	-	-
	Conc. in mg/L										
Thiocyanate	0.4	ND,<.4	6.0	6.5	128.0	160.0	154.0	120%	129.0	150.0	116%
Chloride	1.0	ND	16.8	17.4	86.0	117.1	100.0	116%	70.0	80.3	115%

3 10 00237

3 10 00238

eMoyne RI/FS, Quality Assurance Spike Results; Analysis by Environmental Testing and

* ple I.D. : / .escription : / Compound	Approximate Detection Limit Concentration (ug/l)	8106 23 CHA-16 Blank	8106 20 CHA-16	8106 22 CHA-16 Dup	Spike Conc.	8106 21 CHA-16 Spike Found	8106 21 CHA-16 Spike net	8106 21 CHA-16 Spike % Recovery	Spike Conc.	8106 24 CHA-16 Blank Spike Found	8106 24 CHA-16 Blank Spike % Recovery
Thiocarbamates											
EPTC (Eptam)	1	ND	ND	ND	10.0	11.0	11.0	110%	10.0	11.0	110%
Butylate (Sutan)	1	ND	ND	ND	9.1	11.0	11.0	121%	9.1	11.0	121%
Vernolate (Vernam)	1	ND	ND	ND	15.0	16.0	16.0	107%	15.0	16.0	107%
Pebulate (Tillam)	1	ND	ND	ND	11.6	13.0	13.0	112%	11.6	12.0	103%
Molinate (Ordram)	1	ND	ND	ND	9.8	10.0	10.0	102%	9.8	11.0	112%
Cycloate (Ro-Neet)	1	ND	ND	ND	15.4	17.0	17.0	110%	15.4	17.0	110%
Organophosphates											
Fonofos (Dyfonate)	1	ND	ND	ND	15.5	16.0	16.0	103%	15.5	17.0	110%
Carbophenothion (Trithion)	1	ND	ND	ND	10.5	9.2	9.2	88%	10.5	8.8	84%
Phosmet (Imidan)	1	ND	ND	ND	18.7	3.3	3.3	18%	18.7	1.8	10%
Bensulide (Betasan)	1	ND	ND	ND	15.1	18.0	18.0	119%	15.1	17.0	113%
								===========			===========
							Average	99%		Average	98%
Miscellaneous											
Mercury	0.2	ND,<.3	ND,<.3	ND,<.3	105.0	120.0	120.0	114%	105.0	150.0	143%
Carbon disulfide	0.8	ND,<.4	ND,<.4	ND,<.4	27.0	58.0	58.0	215%	27.0	64.0	237%
Carbon tetrachloride	0.2	ND,<.3	ND,<.3	ND,<.3	34.0	29.0	29.0	85%	34.0	32.5	96%
	Conc. in mg/L										
Thiocyanate	0.4	-	-	-	-	-	-	-	-	-	-
Chloride	1.0	ND	3.0	2.9	69.0	81.8	78.9	114%	69.0	81.6	118%

ND, Not Detected   BMDL, Detected below method detection limit

:h/LeMoyne RI/FS, Quality Assurance Spike Results; Analysis by Environmental Testing and Ce ion

ple I.D. : / escription : / Compound	Approximate Detection Limit Concentration (ug/l)	0105 03 0-39	0105 05 0-39 Dup 03	Avg.	Spike Conc.	0105 04 0-39 spike 03 Found	0105 72 0-39 spike 03 Net	0105 72 0-39 spike 03 % Recovery	Spike Conc.	0106 09 0-39 Blank Spike Found	0106 09 0-39 Blank Spike % Recovery	0105 94 0-29 Blank Spike Spike Conc. Found	by CDM unknown
Thiocarbamates													
EPTC (Eptam)	1	6.1	5.1	5.6	10.0	20.0	14.4	144%	10.0	11.0	110%	ND	
Butylate (Sutan)	1	2.2	2.3	2.3	9.1	16.0	13.7	151%	9.1	11.0	121%	ND	
Vernolate (Vernam)	1	3.5	2.9	3.2	15.0	22.0	18.8	125%	15.0	16.0	107%	ND	
Pebulate (Tillam)	1	BMDL	BMDL	0.0	11.6	15.0	15.0	129%	11.6	12.0	103%	ND	
Molinate (Ordram)	1	9.4	7.6	8.5	9.8	24.0	15.5	158%	9.8	8.9	91%	ND	
Cycloate (Ro-Neet)	1	2.6	1.9	2.3	15.4	22.0	19.7	128%	15.4	15.0	97%	ND	
Organophosphates													
Fonofos (Dyfonate)	1	ND	ND	0.0	15.5	22.0	22.0	142%	15.5	17.0	110%	ND	
Carbophenothion (Trithion)	1	ND	ND	0.0	10.5	22.0	22.0	210%	10.5	8.6	82%	ND	
Phosmet (Imidan)	1	ND	ND	0.0	10.7	ND	0.0	0%	10.7	2.1	14%	ND	
Bensulide (Betasan)	1	BMDL	ND	0.0	15.1	21.0	21.0	139%	15.1	16.0	106%	ND	
								===========			===========		
							Average	133%		Average	94%		
Miscellaneous													
Mercury	0.2	ND	ND	0.0	105.0	110.0	110.0	105%	105.0	100.0	95%	5.0	
Carbon disulfide	0.8	ND,<30	ND,<6	0.0	27.0	ND,<6	0.0	0%	27.0	32.2	119%	ND,<.3	
Carbon tetrachloride	0.2	854.0	1310.0	1082.0	34.0	1310.0	228.0	671%	34.0	31.2	92%	22.0	
	Conc. in mg/L												
Thiocyanate	0.4	-	-	-	-	-	-	-	-	-	-	-	
Chloride	1.0	59.8	60.8	60.3	70.0	137.0	76.7	110%	67.0	77.2	115%	-	

3 10 00239

ND Not ... BMDL Detected below method det...

APPENDIX V

FIELD QUALITY ASSURANCE BLANK RESULTS

3 10 00241

LeMoyne RI/FS; Field Blank Results ; Analysis by Environmental Testing and Certification

Condensed Field Blank Results for Total Priority Pollutant Analysis

Sample I.D. :	8105	8105	8106	8106	8106	8108	8108	8108	8108	8108	8110
Description :	11	34	42	74	94	25	45	58	71	97	14
	blank	blank	blank	blank	blank	blank	blank	Blank	Blank	Blank	Blank
Compound	Concentration ug/L or Kg										
Volatile Compounds	Water	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Chloroform	ND	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	508	BMDL	ND	ND	BMDL	ND	1100	ND	ND	BMDL	BMDL
Toluene	BMDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	776
Base/Neutrals & Pesticides											
bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND	ND	BMDL	ND	1560	2030	ND	ND
Di-n-butyl phthalate	ND	ND	ND	ND	ND	983	BMDL	ND	BMDL	ND	ND
Metals & Cyanide											
Arsenic	ND	ND	ND	ND	ND	ND	BMDL	BMDL	ND	ND	ND
Beryllium	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	BMDL	ND
Cadmium	ND	ND	ND	ND	BMDL	ND	BMDL	ND	ND	ND	ND
Chromium	ND	ND	BMDL	ND	BMDL	BMDL	BMDL	ND	ND	BMDL	ND
Copper	ND	BMDL	BMDL	ND	15000	3900	8700	BMDL	ND	ND	BMDL
Lead	ND	ND	ND	BMDL	BMDL	BMDL	BMDL	BMDL	ND	BMDL	BMDL
Mercury	ND	BMDL	ND	BMDL	ND	ND	ND	ND	ND	ND	ND
Nickel	ND	ND	BMDL	BMDL	BMDL	BMDL	ND	BMDL	BMDL	BMDL	ND
Selenium	ND	ND	ND	BMDL	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND	ND	ND	BMDL	ND	ND	ND
Zinc	16	8000	5700	1500	3600	5500	1300	3300	2000	2200	3400
Cyanide, Total	ND	ND	ND	1900	ND	ND	ND	ND	ND	ND	ND

ND Not Detected BMDL Detected but below stated MDL

3 10 00242

C-14 Creek/LeMoyne RI/FS; Field Blank Results for Site Specific Parameters ; Analysis by Environmental ... and Certification

Sample I.D. :		0100 98	0100 88	0110 15	0100 26	0100 46	0106 42	0106 75	0100 59	0100 72	0106 93	0105 95	0105 80	0105 11	0105 34
Location					OCTC-23	OCB-23		LLP-23			LLP-23	O-23	O-39	CCN-7-1	CCB-3a
Depth in feet		Blank	Blank	Blank	blank	Blank	Blank	blank	Blank	Blank	blank	CRM 01.	blank	blank	blank
Compound	Detection Limit														
Thiocarbamates	Conc. (mg/kg)														
EPTC (Eptam)	0.1	ND	ND	-	-	-	-	-	ND	ND	-	ND	ND	ND	ND
Butylate (Sutan)	0.1	ND	ND	-	-	-	-	-	ND	ND	-	ND	ND	ND	ND
Vernolate (Vernam)	0.1	ND	ND	-	-	-	-	-	ND	ND	-	ND	ND	ND	ND
Pebulate (Tillam)	0.1	ND	ND	-	-	-	-	-	ND	ND	-	ND	ND	ND	ND
Molinate (Ordram)	0.1	ND	ND	-	-	-	-	-	ND	ND	-	ND	ND	ND	ND
Cycloate (Ro-Neet)	0.1	ND	ND	-	-	-	-	-	ND	ND	-	ND	ND	ND	ND
Organophosphates															
Fonofos (Dyfonate)	0.1	-	-	-	-	-	-	-	ND	ND	-	ND	ND	ND	-
Carbophenothion (Trithion)	0.1	-	-	-	-	-	-	-	ND	ND	-	ND	ND	ND	-
Phosmet (Imidan)	0.1	-	-	-	-	-	-	-	ND	ND	-	ND	ND	ND	-
Bensulide (Betasan)	0.1	-	-	-	-	-	-	-	ND	ND	-	ND	ND	ND	-
Miscellaneous	Conc. (mg/kg)														
Carbon disulfide	0.2	-	-	-	ND	ND	-	ND	-	-	ND	0.006	ND	0.44	-
Carbon tetrachloride	0.2	-	-	-	ND	ND	-	ND	-	-	-	ND	ND	ND	-
Mercury	0.3	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	BMDL
Vanadium	1100	-	-	-	-	-	-	-	-	-	BMDL	-	-	-	-
Iron	16000	-	-	-	-	-	100000	-	-	-	-	-	-	-	-
	Conc. (mg/kg)														
Chloride	50	-	-	-	-	-	-	ND	-	-	ND	-	ND	ND	ND
Thiocyanate	10	-	-	ND	-	-	-	-	-	-	-	-	-	ND	-
Phosphorus		-	-	-	-	-	-	-	ND	ND	-	-	-	-	-
Sulfate	150	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
Sulfite	100	-	-	-	-	-	ND	-	-	-	-	-	-	-	-
Sulfide	5	-	-	-	-	-	ND	-	-	-	-	-	-	-	-

ND, Not Detected; BMDL, Detected below stated method detection limit; " - " Analysis not required;

3 10 00243

APPENDIX VI

SAMPLING PROTOCOL, ANALYSIS AND QUALITY ASSURANCE

APPENDIX VI

Sampling:

Protocol

All sampling activities were carried out according to the protocols in the Sampling and Analysis Manual prepared by Stauffer Chemical Company specifically for this investigation, "Remedial Investigation/Feasibility Study Cold Creek/LeMoyne Site". The manual details the basic sampling principles used throughout the investigation, such as: the sample collection procedures, the sampling devices, sampling containers, preservation, holding times, and decontamination procedures before and during sampling. It also details the required quality assurance and quality control procedures, such as: frequency of collection of field blanks, field spikes, field duplicates and the chain of custody procedures used.

Sampling Plan

The proposed sampling and analysis for this investigation were detailed in the final work plan prepared by Camp Dresser and McKee, Inc. (CDM). In the work plan this portion of the investigation was divided into the source characterization and an area characterization. The source characterization was further subdivided into three categories: 1) Cold Creek/LeMoyne Swamps, 2) Ponds, Lagoons and Area Wells, and 3) Landfills. The samples to be collected for each of these facets of the investigation are outlined in six tables in the Work Plan. These tables have been reproduced and included as Appendix I-1.

Actual Samples Collected

Samples were collected from the beginning of May 1986, through the beginning of August 1986. Samples were not collected in the order outlined in the sampling plan, but were collected in batches in which samples requiring similar analyses were grouped together. This was done to maximize the efficiency of the use of field quality assurance samples. A chronological list of the samples collected is given in Appendix I-2. In these tables the field notebook sample reference number, the sample identification from the sampling plan, the date the samples were shipped for analysis, and the analytes determined are listed.

All the sampling was done according to the requirements of the Work Plan excluding the exceptions noted for the samples listed below.

NM-1	Cyanide was not determined in this sample because the sample bottle broke in shipment.
CWA-8	This Courtaulds' production well was not sampled because it was inoperative due to a collapse.
HTP-1s	This bore hole was not continued past ten feet because of concern that lower samples would be contaminated from the sludge encountered nearer the surface. Instead, a 45° angle bore hole was sampled adjacent to HTP-1s. This extra bore hole was labeled HTP-3s.
SCC-52, SCC-78	The contract laboratory analyzed these two samples for carbon tetrachloride in addition to carbon disulfide. The results for carbon tetrachloride, not detected, were reported although the analysis was not requested.
SW-01-1w, SW-01-2w, SW-11-1w, SW-11-2w	The Work Plan indicated that all four of these samples were water samples. Discussion with Camp Dresser and McKee at the time of sampling clarified that they were intended to be one water and one surface sediment at both SW-01 and SW-11.
Bore Holes	Many of the bore holes had to be relocated due to access problems.

3 10 00245

Analysis

All analyses were done by Environmental Testing and Certification, Inc. Analytical methods used are summarized in table 1. Where available, methods were from SW-846, EPA 600 Methods, "Standard Methods for the Examination of Water and Wastewater", or from other EPA referenced sources. Two groups of site specific parameters were not done by methods from the sources listed above. The thiocarbamates and organophosphates were analyzed by a Stauffer developed procedure because no other documented procedure was available. Carbon disulfide and carbon tetrachloride were analyzed using a modification of EPA Method 8240 (GC/MS) which utilized selected ion monitoring. This was done to provide lower detection limits than the standard method allows.

The results of analysis were reported by ETC to Stauffer with full documentation for each sample, with a separate report in the form of a booklet for each individual sample. The results reported by ETC include documentation of the chain of custody, internal laboratory quality assurance results, and copies of chromatograms and other chromatographic data. This documentation is on file at ERC and at ETC.

The results provided by ETC have been compiled and are in Appendices II through V. Appendix II contains the results for the total priority pollutant analyses and a few site specific analyte results. Appendix III contains the remainder of the site specific results. Appendices IV and V contain the results for the field quality assurance spikes and blanks, respectively. In the actual analysis, there were two variations from the methodology required in the stated procedures.

In some cases, the priority pollutant GC/MS analyses were done by variations of the SW-846 methods which were more similar to the Contract Laboratory Procedures than SW-846. The variations from SW-846 were to use a larger sample weight, or to concentrate the methylene chloride extract further than required by the SW-846 methodology. Each of these variations results in lower detection limits than obtained using strictly SW-846 methodology. These variations in methodology are noted in the tables of results by the different detection limits indicated for the GC/MS work.

For three site specific categories of analytes (thiocarbamates, organophosphates, and elemental phosphorus) the required holding times were exceeded due to problems which required reanalysis of retained samples. Field quality assurance spike results indicated that this may have caused low recoveries for one of the organophosphate pesticides. This is discussed further in the quality assurance section.

Quality Assurance

The general quality assurance procedures used for this project are described in the Sampling and Analysis manual. In the manual, the equipment cleaning procedures, sampling procedures, preservation procedures and frequency of field quality assurance samples are given. The laboratory quality assurance procedures used by Environmental Testing and Certification are indicated in the complete reports provided by ETC.

The general frequency of quality assurance samples in the field and in the laboratory were the same. For every batch of approximately fifteen samples, there was a field and laboratory blank, a field and laboratory duplicate and a field and laboratory blank spike and sample spike. For soil samples, field spikes were omitted. All of the field quality assurance samples were blind to the laboratory.

Field Quality Assurance Spikes

The results for the field quality assurance spikes are given in Appendix IV. There was one set of field quality assurance spikes for total priority pollutant analysis. A total of 57 analytes were added in the blank spike and sample spike. The overall recoveries for the two spiked samples were very good. There were some analytes with low recoveries, but in all cases these were for compounds known to be unstable in water or unstable to the conditions used in the analysis. The compounds known to be unstable are indicated in the October 26, 1984 Federal Register in which the EPA established acceptable quality assurance spike recoveries under the Clean Water Act.

There were 4 complete sets of quality assurance spikes for the site-specific parameters. The analytes spiked depended on the particular analyses required for the batch of samples being analyzed. In general, the recoveries for the site-specific spikes were very good. There was one case of no recovery for carbon disulfide in a sample spike. This was caused by interference from the high concentration of carbon tetrachloride, 1310 ppb, in this sample relative to the concentration of carbon disulfide spiked, 27 ppb.

Recovery was poor for Imidan for all 8 of the spiked samples. Recovery ranged from 0% to 19% with an average recovery of 10%. This poor recovery was probably contributed to by the fact that the samples for organophosphates, thiocarbamates and phosphorus were analyzed after Stauffer's recommended holding time of 7 days. It is not known what type of recovery could be expected if the holding time had been met. Hydrolytic stability data from Stauffer's Western Research Center shows Imidan to have a half life of only 1 day at 20°C and a pH of 7.

Field Quality Assurance Blanks

One field quality assurance blank sample was analyzed with every batch of approximately 15 samples. The quality assurance blank results are in Appendices II and III along with the actual sample results. The blank results are also summarized in Appendix V.

There were a total of 11 field blanks for total priority pollutant analysis. Four common laboratory contaminants [methylene chloride, toluene, bis(ethylhexyl)phthalate, and Di-n-butylphthalate] were found in one or more blanks at concentrations near or below the method detection limits. These four compounds were reported in the actual samples at a similar frequency and concentration. Any reported detections of these compounds at low levels should be considered invalid. It is recognized by the EPA in the Contract Laboratory Procedures manual that contamination by these common laboratory contaminants is unavoidable.

Methylene chloride was found in the water field blank and field blank spike at an elevated level, about 500 ppb. This was found to be due to contamination of a bottle in which the sample was prepared. This contamination of the field blank and blank spike had no impact on the actual samples results.

Two other organic compounds were detected in the field blanks; chloroform at a level below the method detection limit in one sample and trichloroethylene near the detection limit in another sample. These detections of miscellaneous compounds near or below the method detection limits support the view that any detections near the method detection limit should be considered suspect and any detections below the method detection limit should be considered invalid.

There was one detection of cyanide at 1.9 ppm, about 4 times the detection limit, in one of the 11 field blanks. There were two actual samples in which cyanide was detected at 4 to 6 times the detection limit. These detections may be questioned based on the quality assurance blank results.

There were two priority pollutant metals for which detections were reported at levels above the method detection limits in one or more of the 11 field blanks. Copper was reported in 3 solid matrix blanks at 4 ppm, 9 ppm and 15 ppm. Zinc was reported in all the blanks at from 1.5 ppm to 8.8 ppm. Based on these blank results, a reported concentration of less than about 10 ppm should be considered a probable blank level for these metals.

Fourteen field blanks were submitted for site-specific analyses. Carbon disulfide and iron were the only analytes detected in any of the blanks. Carbon disulfide was detected in two of seven samples at 0.4 ppb, twice the detection limit. Iron was detected at 100 ppm in the one field blank submitted. This reported concentration of iron is insignificant compared to the percent levels found in the actual samples.

Field Duplicates

The results for the field duplicates were acceptable. Most of the results for duplicates agreed within a factor of two. Except for one duplicate pair, any apparent disagreements were for detections near the method detection limits. In one case, carbon tetrachloride in sample OCS-2s, there was an order of magnitude different between the duplicates. This is attributed to the difficulty with providing good homogenization of a soil sample wh still maintaining the integrity of the sample for volatiles analysis.

3 10 00248

Cold Creek/LeMoyne RI/FS Sampling and Analysis Requirements

Analytes Category	Sub-Category	Methods* Water	Soil	Technique	Holding Time (Weeks)	Preservative All soils cool 4oC, Aqueous below:
Priority Pollutants						
	Extractables	3510/8270	3540/2870	GC/MS	1	Ph 6-9, .008% thiosulfate if residual Cl2, cool
	Volatiles	5030/8240	5030/8240	GC/MS	2	0.008% thiosulfate if residual Cl2, cool 4oC
	Cyanides (Technicon II GT)	9010	9010	Colorimetric	2	NaOH pH>12, 0.6g ascorbic acid if residual Cl2, c
	Metals					Filter through 0.45 um filter, HNO3 to pH <2
	Antimony	6010	6010	ICAP	24	-
	Arsenic	7060	7060	Furnace	24	-
	Beryllium	6010	6010	ICAP	24	-
	Cadmium	6010	6010	ICAP	24	-
	Chromium	6010	6010	ICAP	24	-
	Copper	6010	6010	ICAP	24	-
	Lead	6010	6010	ICAP	24	-
	Mercury	7470	7471	CVAA	4	-
	Mercury in Fish	(1)	(1)	CVAA	4	Freeze with dry ice
	Nickel	6010	6010	ICAP	24	-
	Selenium	7740	7740	Furnace	24	-
	Silver	6010	6010	ICAP	24	-
	Thallium	7840	7840	Furnace	24	-
	Zinc	6010	6010	ICAP	24	-
laneous Metals						
	Iron	-	6010	ICAP	24	-
	Vanadium	-	6010	ICAP	24	-
Thiocarbamates and Organophosphates		SCC-EMC-275b	SCC-EMC-275c	GC/NPD	1	Ph 5-9, .008% thiosulfate if residual Cl2, cool
Chloride		325.3	325.3	Colorimetric	4	cool 4oC
Carbon Disulfide and Carbon Tetrachloride		5030/GC/MS-SIM	5030/GC/MS-SIM	GC/MS	2	0.008% thiosulfate if residual Cl2, cool 4oC
Thiocyanate		-	412.k(2)	Colorimetric	2	-
Sulfide		-	376.2(3)	Colorimetric	4	-
Sulfite		-	377.1(3)	Titrimetric	4	-
Sulfate		-	375.3(3)	Gravimetric	4	-
Elemental Phosphorus		-	(4)	GC/FPD	1	-

* ; SW-846 unless noted

(1) Interim Methods for the Sampling and Analysis of Priority Pollutants in Sediment and Fish Tissue U.S.E.P.A. EMSL, August 1977, revised October 1980

Standard Methods for the Examination of Water and Wastewater, 15th Ed.

(3) Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised March 1983

(4) "Direct determination of elemental phosphorus by gas-liquid chromatography" R.F. Addison and R.G. Ackman, Journal of Chromatography, 47 (1970) 421-426

3 10 00249

APPENDIX VII

THOMPSON ENGINEERING TESTING INC., REPORT ON NEW WELLS

3 10 00250

THOMPSON ENGINEERING TESTING, INC.

Geotechnical, Materials and Environmental Engineers • Laboratories

Main Office and Laboratories
3707 Cottage Hill Road • 205/666-2443

Nondestructive Testing and Examination
4234 Halls Mill Road • 205/666-1435

P O Drawer 9637 Mobile Alabama 36691

May 12, 1986

Stauffer Chemical Company
P.O. Box 100
Axis, Alabama 36505

Attention: Mr. William P. Stilson

Subject: Groundwater Monitoring Well Installation
Lemoyne Plant

Gentlemen:

Thompson Engineering Testing, Inc. has completed the installation of groundwater monitoring wells at the site of the Lemoyne Plant, Stauffer Chemical Company, Axis, Alabama. Authorization to proceed with the installations was issued by Mr. William Stilson on April 18, 1986 following site reconnaissance by our engineering staff. Reference is made to our proposed schedule of fees dated March 3, 1986, and Stauffer Chemical Company purchase order No. 25-384442 dated April 22, 1986.

This report presents well installation procedures, groundwater monitoring well construction details, and results of well completion. Groundwater monitoring well installation was directed on-site by Mr. William Stilson, Geologist for Stauffer Chemical Company.

Two (2) groundwater monitoring wells were installed at the subject site at locations specified by Mr. Stilson between 37.0 and 62.5 feet below existing ground surface. Each well borehole was performed using the mud-rotary drilling technique and BW drill rod with adapted 9.0-inch and 7.88-inch diameter three-winged drag bit. Slow advance of the drill stem enabled visual classification of soil material and approximate determination of depth at which the underlying soil strata were encountered.

Confirmation soil samples were obtained within the well-screen interval and in natural sands using an 18-inch by 2-inch O.D. split-barrel sampler driven by a 140-pound hammer falling a standard height of 30-inches. The number of blow counts recorded for the final 12-inches of split-barrel penetration are reported as the standard penetration resistance and provide an indication of cohesionless soil relative density and cohesive soil consistency. Weight-of-Hammer (WOH) and Weight-of-Rod (WOR) are reported in lieu of blow counts where soils sampled are very loose or soft.

Following borehole completion, the pre-assembled well casing was lowered into the borehole and subsequently flushed with pumped clean water to displace downhole drilling fluid.

Well casings consisted of 4-inch I.D., Schedule 40 PVC having "Tri-Loc" flush threaded couple joints manufactured by Brainard-kilman. Screen intervals have 0.010-inch width machined slots spaced on 0.25 inch centers resulting in an intake area of 5.16 square inches per linear foot and rated flow capacity of 1.60 GPM per linear foot under ideal conditions. The annular space between well-screen sections and borehole were sand-packed using commercially available well-rounded and uniformly graded (20/40) silica sand where borehole sidewalls remained stable. The particle size distribution curve for the sand-pack material is provided in the attached information. The remainder of the borehole annulus was completed with a cement-bentonite grout tremied from bottom to top. Bentonite Pellets, 1/2-inch in diameter, were used to create an impermeable seal within the annulus and minimum of 24-inches above the screen interval. A 4-foot square timber form was placed about the well riser for emplacement of the concrete collar.

At the request of our staff, a 100 CFM air compressor and the "Air-Lift" method was used at an attempt to evacuate and develop the groundwater monitoring wells. However, due to the semi-submerged construction of the well screen interval, this method was unsuccessful.

As an alternate method of well development, a swab surging tool and electric submersible pump were used. Continued use of the surge agitation-withdrawal technique for 14.5 hours resulted in clear water discharge and continuous pumping rate of 5 GPM in Well No. NM-1. Using a similar technique in Well No. NM-2 for 7.6 hours, a clear water discharge and continuous pumping rate of 8 GPM was achieved. Based upon well recovery rates and computation of permeability of natural sands per U.S. Department of The Navy, Naval Facilities Engineering Command, 1974, values greater than 1.65 X 10-4 cm/sec compare favorably with estimates for the soils encountered and having particle size distributions as provided.

It is noted that during the surge agitation-withdrawal technique on NM-1, electrical connections to submersible pump became detached from their bindings and allowed an unknown amount of pump motor lubricating oil to discharge into the well water. Upon its recognition, no further development was performed until a replacement motor was obtained. Our staff is confident that leakage was minimal, and assurance was made by our field crew to evacuate the well volume prior to additional surge agitation. Our firm retains a sample of the pump-motor lubricating oil for future reference should the analyses of water require comparison.

3 10 00252

Thompson Engineering Testing, Inc. has appreciated the opportunity to provide Stauffer Chemical Company with our groundwater well installation services. Should there by any questions regarding the information presented herein, please do not hesitate to contact us.

Sincerely,

THOMPSON ENGINEERING TESTING, INC.

E. Fletcher Thompson

E. Fletcher Thompson
Geotechnical Engineer
EIT No. 8830

EFT/cw

10 00253

THOMPSON ENGINEERING TESTING, INC.

ENGINEERS TESTING LABORATORIES

MOBILE, ALABAMA BILOXI, MISSISSIPPI

GROUNDWATER WELL LOG

CLIENT: Stauffer Chemical Company

GROUND ELEVATION: ~44.5'

Casing Elevation: ~46.91',

[illegible] 44.78'

PROJECT: Lemoyne Plant

DATUM: M.S.L.

JOB NO.: E86-069

DATE DRILLED: 4/23/86

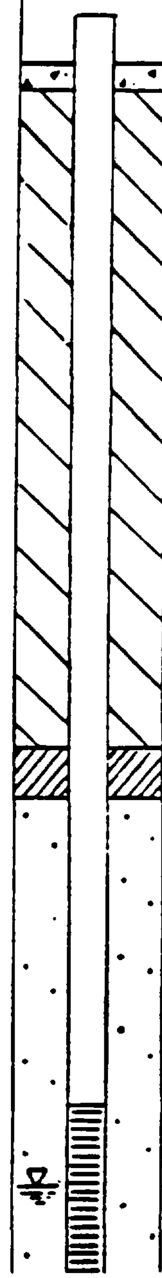
GR. WATER DEPTH: 48.0'
(Below Ground Surfa

BORING NO.: MW-1

LOCATION: S. 1984.53' E. 5769.92'

TYPE BORING: ASMT D-1586

DEPTH IN FEET	LOG	SAMPLE	DESCRIPTION	NO.	BLOWS PER FT. NO	GRAPH 5 10 20 30 40 50	WELL INSTALLATION DETAIL
0			Medium brown SAND				Concrete
			Medium tan and gray SAND				
5			Fine tan SILTY CLAY				Cement/ Bentonite Grout
			Medium red SAND w/traces of fine CLAY				
10			Medium tan SAND				
15							
20							
25			Fine orange SAND				
30							Bentonite Seal
35			Fine tan SILTY SAND				
40							20/40 Sand-Pack and Collapsed Natural Sands
45							
50				1	Hand Driven		



3 10 00254

THOMPSON ENGINEERING TESTING, INC.

ENGINEERS TESTING LABORATORIES

MOBILE, ALABAMA　　BILOXI, MISSISSIPPI

GROUNDWATER WELL LOG

CLIENT: Stauffer Chemical Company

GROUND ELEVATION: +44.5

Casing Elevation: +46.91'

PROJECT: Lemoyne Plant

DATUM: M.S.L.

JOB NO.: E86-069

DATE DRILLED: 4/23/86

GR. WATER DEPTH: 48.0' (Below Ground Sur

BORING NO.: MW-1 (Cont.)

LOCATION S. 1984.53' E. 5769.92'

TYPE BORING: ASTM D-1586

DEPTH IN FEET	LOG	SAMPLE	DESCRIPTION	NO.	BLOWS PER FT. NO	GRAPH 5 10 20 30 40 50	WELL INSTALLATION DETAIL
			Fine tan SILTY SAND				20/40 Sand-Pack and Collapsed Natural Sands
0			FIRM fine tan and yellow SILTY SAND	2	27		
5			FIRM fine tan SILTY SAND	3	16		
			B.T. @ 62.5'				
10							
15							
20							
25							
30							
35							
40							
45							
50							

THOMPSON ENGINEERING TESTING, INC.
ENGINEERS TESTING LABORATORIES
MOBILE, ALABAMA   BILOXI, MISSISSIPPI

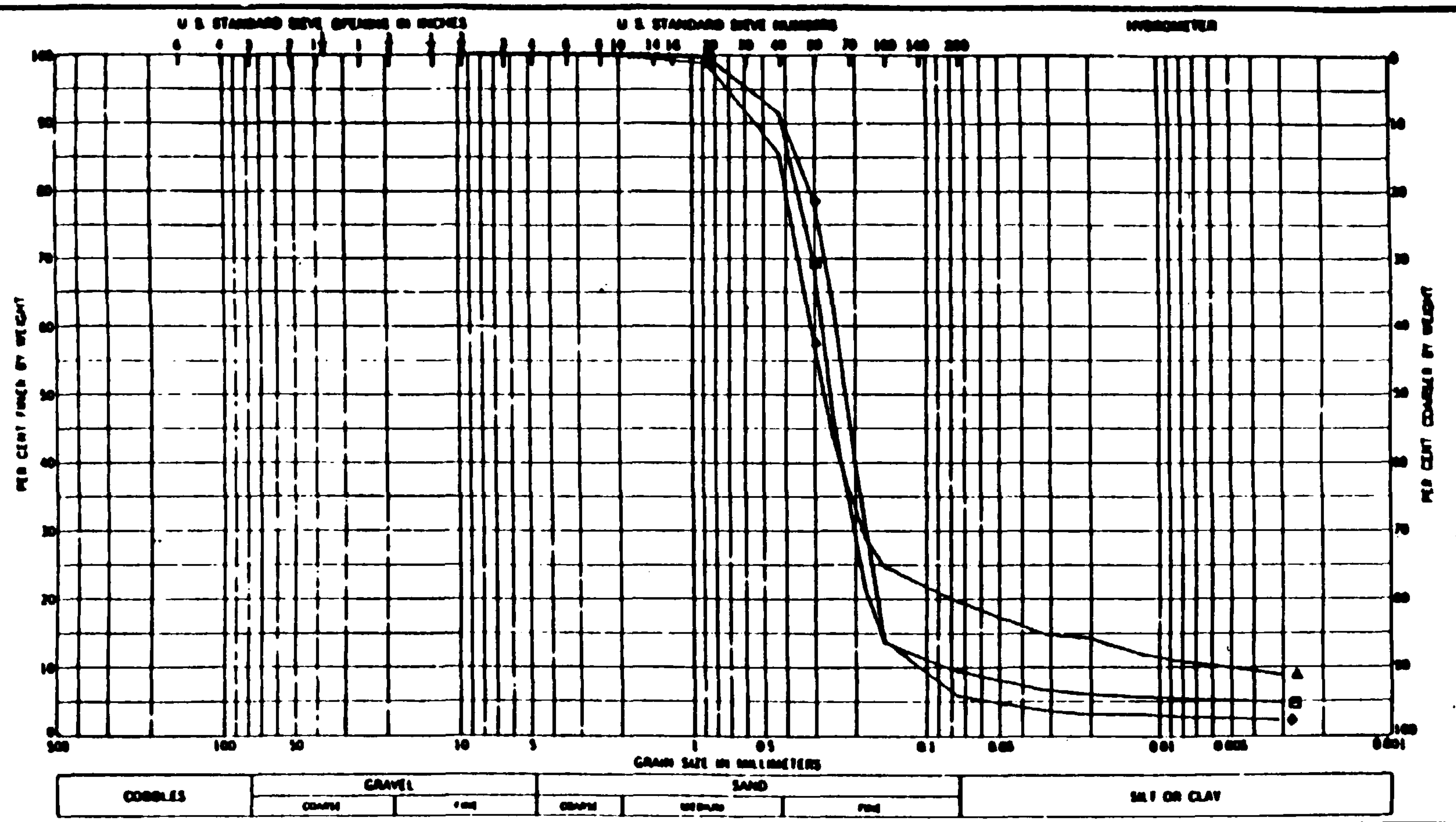
GROUNDWATER WELL LOG

CLIENT: Stauffer Chemical Company
GROUND ELEVATION: +21.
Casing Elevation: +24.91'
[illegible] +22.4'
PROJECT: Lemoyne Plant
DATUM: M.S.L.

JOB NO.: E86-069
DATE DRILLED: 4/23/86
GR. WATER DEPTH: 24.3'
(Below Ground S
Top of CAS[illegible]

BORING NO.: MW-2
LOCATION: S. 1988.72' E. 6663.76'
TYPE BORING: ASTM D-158[illegible]

DEPTH IN FEET	LOG	SAMPLE	DESCRIPTION	NO.	BLOWS PER FT. NO	GRAPH 5 10 20 30 40 50	WELL INSTALLATION DETAIL
0			Fine brown SILTY SAND				Concrete
			Medium tan and orange SAND				
5							Cement/ Bentonite Grout
10							
15							Bentonite Seal
20							
			FIRM fine white and tan SAND to SILTY SAND				20/40 Sand-Pack and Collapsed Natural Sands
25				1	11		
30				2	28		
35				3	21		
			B.T. @ 37.0'				
40							
45							
50							



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
◆ S-1	48.0 - 49.5	FINE SILTY SAND (SP-SM)	---	---	---	---
⊠ S-2	55.0 - 56.5	FINE SILTY SAND (SP-SM)	---	---	---	---
▲ S-3	60.0 - 61.5	FINE SILTY SAND (SM)	---	---	---	---

Project LEMOYNE PLANT MONITORING WELLS

Job No. E86069

Area STAUFFER CHEM. CO.

Boring No. MW-1

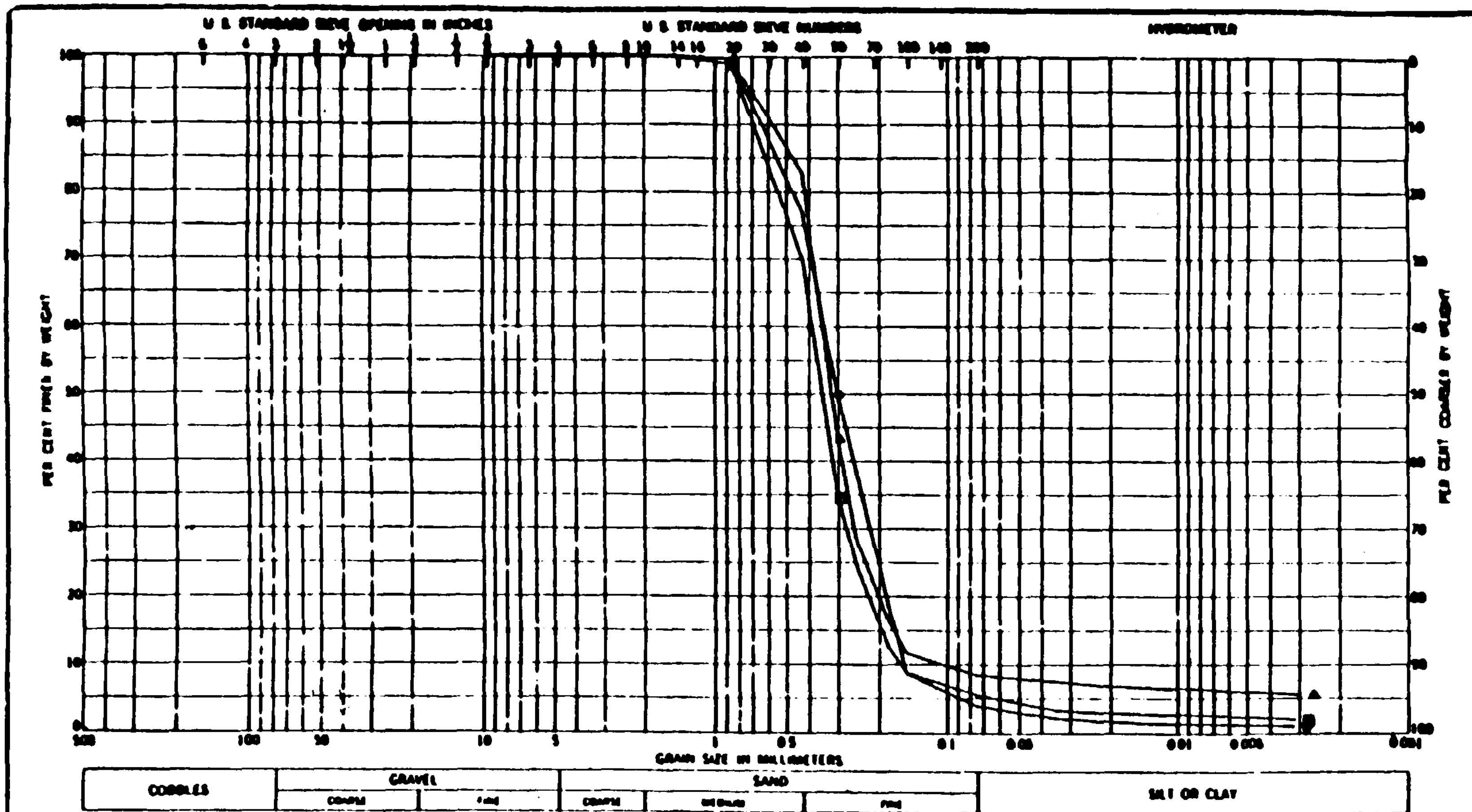
Date 04/29/86

GRADATION CURVES

THOMPSON ENGINEERING TESTING, INC.
CHEMICAL MATERIALS AND GEOTECHNICAL LABORATORIES

3 10 00256

3 10 00257



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
● S-1	23.0 - 24.5	MED. FINE SAND (SP)	---	---	---	---
■ S-2	30.0 - 31.5	MED. FINE SILTY SAND (SP-SM)	---	---	---	---
▲ S-3	35.0 - 36.5	MED. FINE SILTY SAND (SP-SM)	---	---	---	---

GRADATION CURVES

Project LEMOYNE PLANT MONITORING WELLS

Job No. E88069

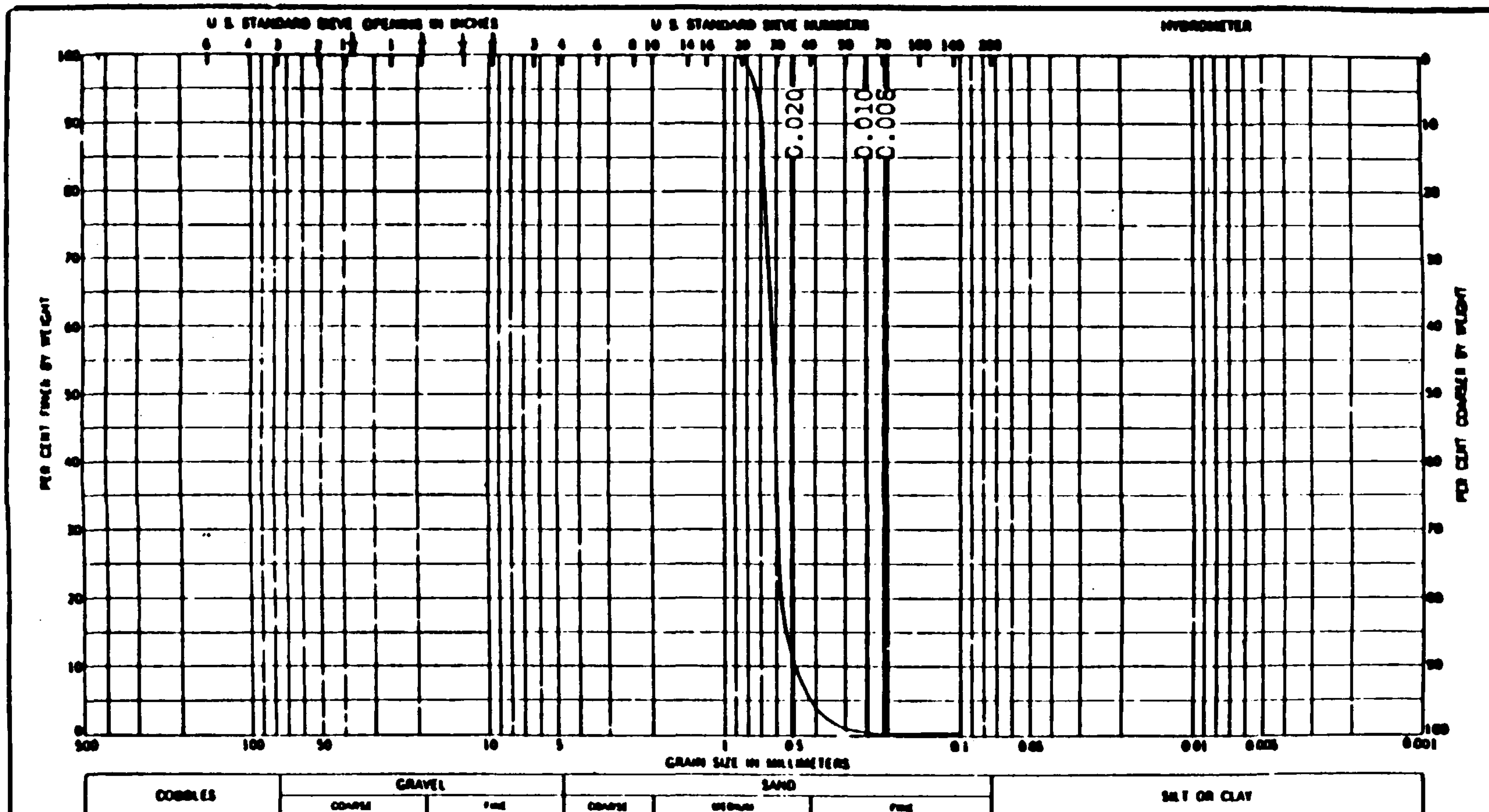
Area STAUFFER CHEM. CO.

Boring No. MW-2

Date 04/29/88

THOMPSON ENGINEERING

CHEMICAL, MATERIALS AND GEOTECHNICAL LABORATORIES



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
		IS&A 20/40				
		Sand-Pack Material				
		$C_u = 1.22$ $C_c = 0.876$				

(Well Screen Slot Size in Inches)

GRADATION CURVES

Project

Job No.

Area

Boring No.

Date

3 10 00258

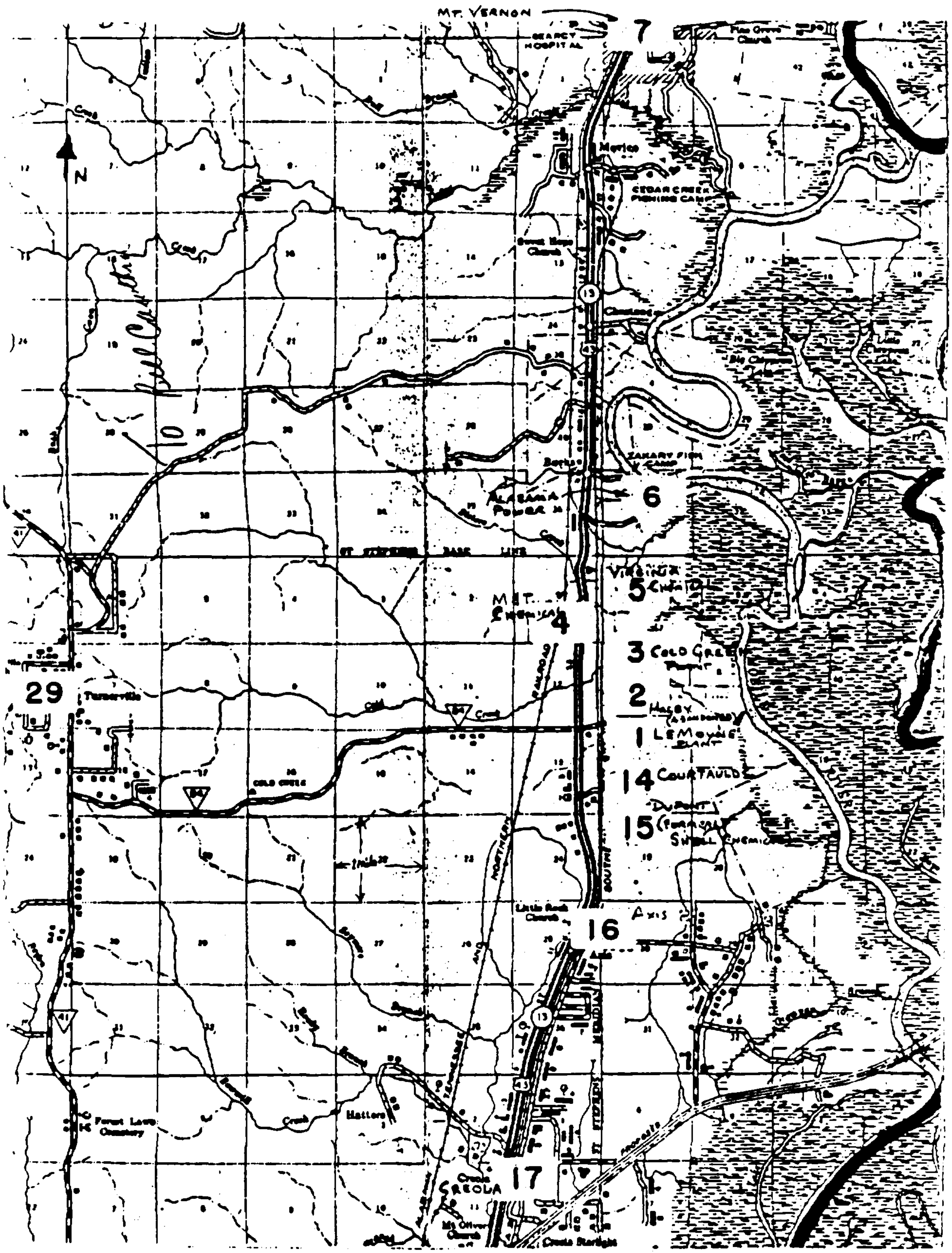
VESTER J. THOMPSON, JR., INC.

APPENDIX VIII
POPULATION DENSITY DISTRIBUTION MAP

3 10 00260 Appendix - VIII

Population Density - Distribution

Note - Houses are shown as Black Boxes



3 10 00261

APPENDIX IX

RAINFALL INTENSITY DATA, MEMO 9/26/78

3 10 00262

Appendix · IX

Stauffer

INTER-OFFICE CORRESPONDENCE

Cold Creek

To Location: Dobbs Ferry   From: Bill Erdmann   Date: 9/26/78

To: Bill Cawthra   Subject: Rainfall (Intensity)

The following information on high rainfall was obtained from the U. S. Department of Commerce Weather Bureau. Local climatological data for Mobile, Alabama, Bates Field.

Rainfall exceeded 2.5" in 24 hour period in last 20 years (27) twenty-seven times.

Rainfall exceeded 3" in 24 hour period in last 20 years (26) twenty-six times.

Rainfall exceeded 4" in 24 hour period in last 20 years (9) nine times.

Rainfall exceeded 6" in 24 hour period in last 20 years (4) four times.

Rainfall exceeded 3" or more (39) thirty-nine times in past 20 years.

Highest rainfall in a one hour period recorded 2.99".

Rainfall of over 6" in past 20 years:

June 1961	6.08"	Sep. 1974	6.17"
Sep. 1967	6.58"	Nov. 1975	7.01"

Recorded rainfall of over 2" in one hour for past 20 years:

Mar. 1958	2.11"	Aug. 1963	2.06"
May 1960	2.75"	Apr. 1964	2.99"
Mar. 1961	2.10"	Nov. 1975	2.03"

Other hourly rainfall:

4.37" in 3 hours June 1961.

2.83" in 2 hours May 1978.

This information was taken from official records established at a location approximately 40 miles from the plant site and due to the weather pattern for this area may or may not represent a true picture of this location.

Attached is a full copy of records for the past 20 years.

SAFEGUARD COMPANY INFORMATION

FORM 0032-000-00 A

Bill

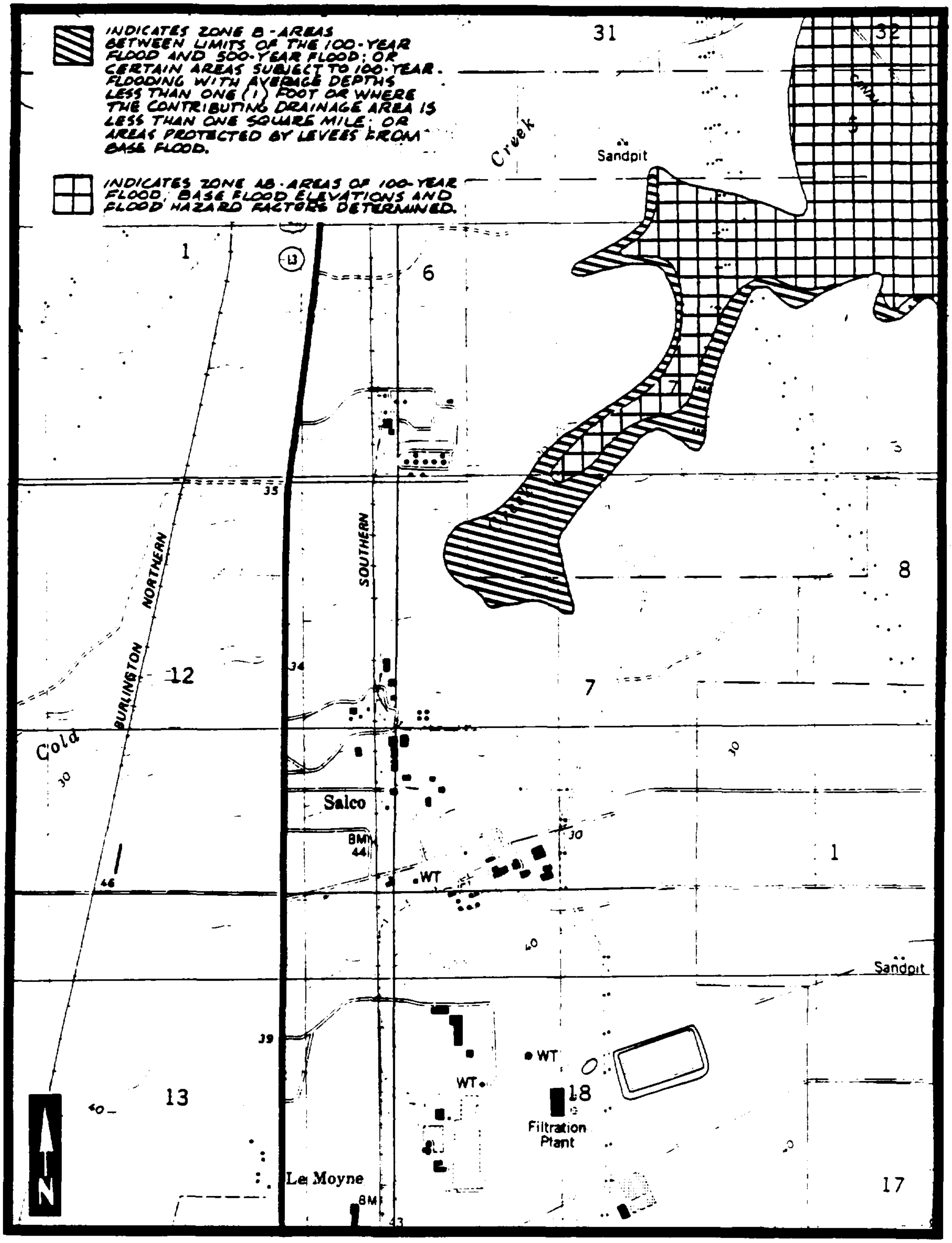
Bill

BE:aa

3 10 00263

APPENDIX X

SWAMP AREA ENCOMPASSED BY FLOOD PLAIN



Note: Flood Information from Flood Insurance Rate Map, Community Panel No. 015008 0125 F & 0150 F, Revised 1-3-85.

Topographic Information Taken From USGS Topo Map, 1982.

0 .5 1 Mile
SCALE

8801023

Figure 10-1 Swamp Area Encompassed by Flood Plain

APPENDIX XI

WIND GRAPHS

3 10 00266

APPENDIX - XI

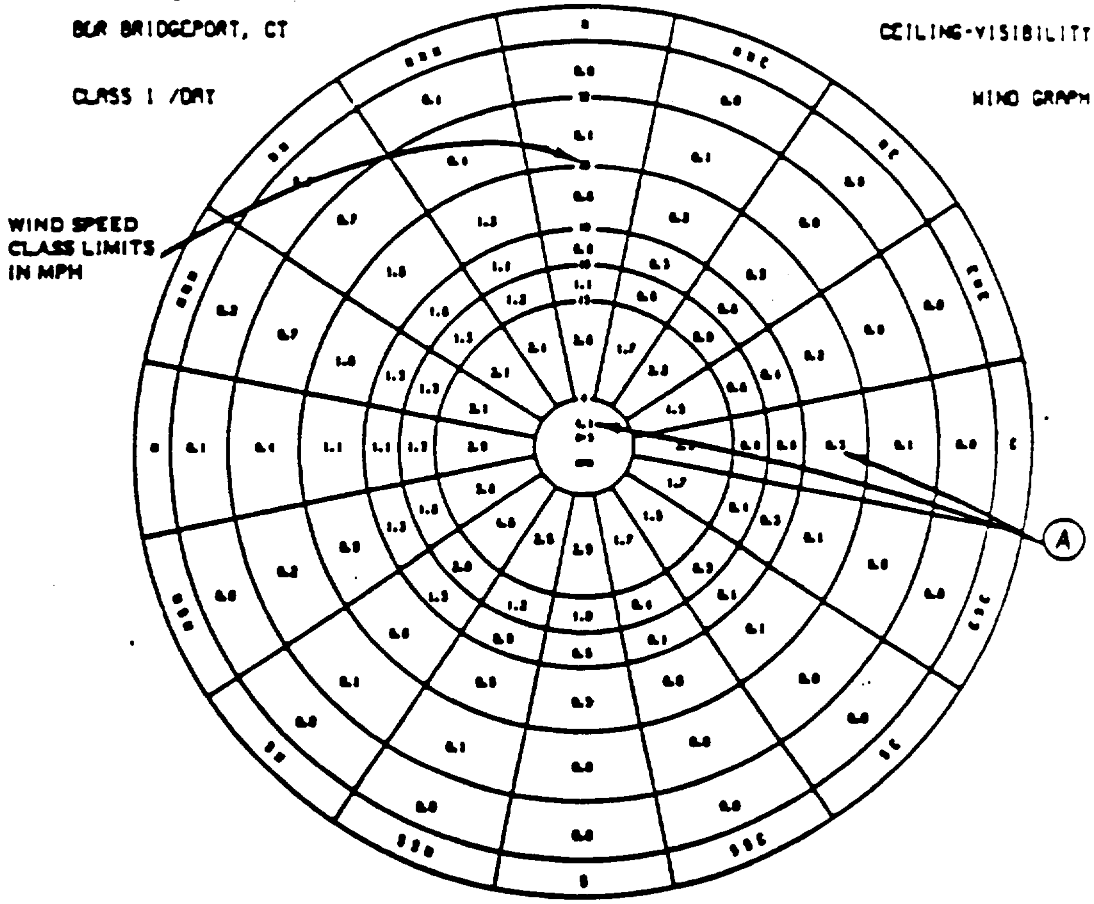
Sample

BDR BRIDGEPORT, CT

CLASS 1 /DAY

CEILING-VISIBILITY

WIND GRAPH



A—NUMBER OF DAY (NIGHT) OBSERVATIONS IN A GIVEN CEILING-VISIBILITY CLASS, WIND SPEED CLASS AND DIRECTION DIVIDED BY THE TOTAL NUMBER OF DAY (NIGHT) OBSERVATIONS IN CEILING-VISIBILITY CLASSES 1, 3-4, ALL WIND SPEED CLASSES AND DIRECTIONS TIMES 100.

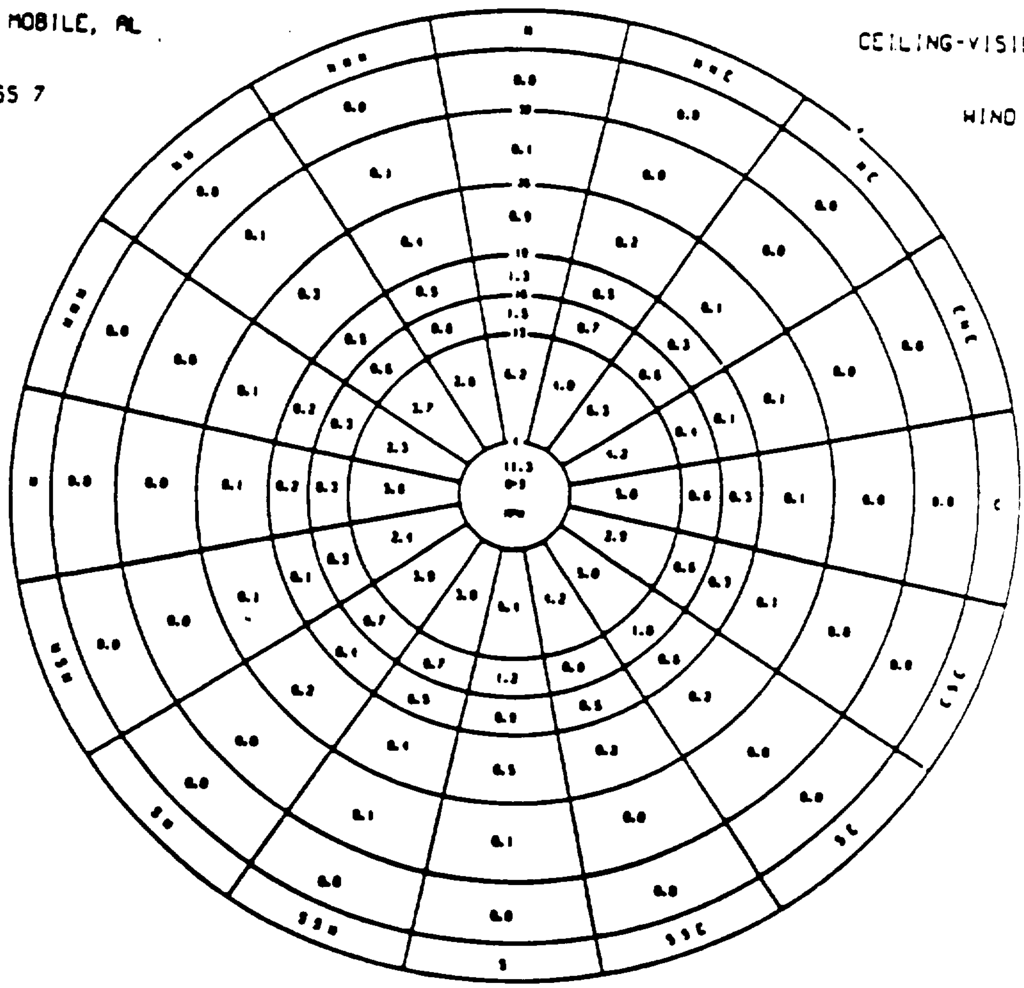
3 10 00267

MOB MOBILE, AL

CLASS 7

CEILING-VISIBILITY

WIND GRAPH

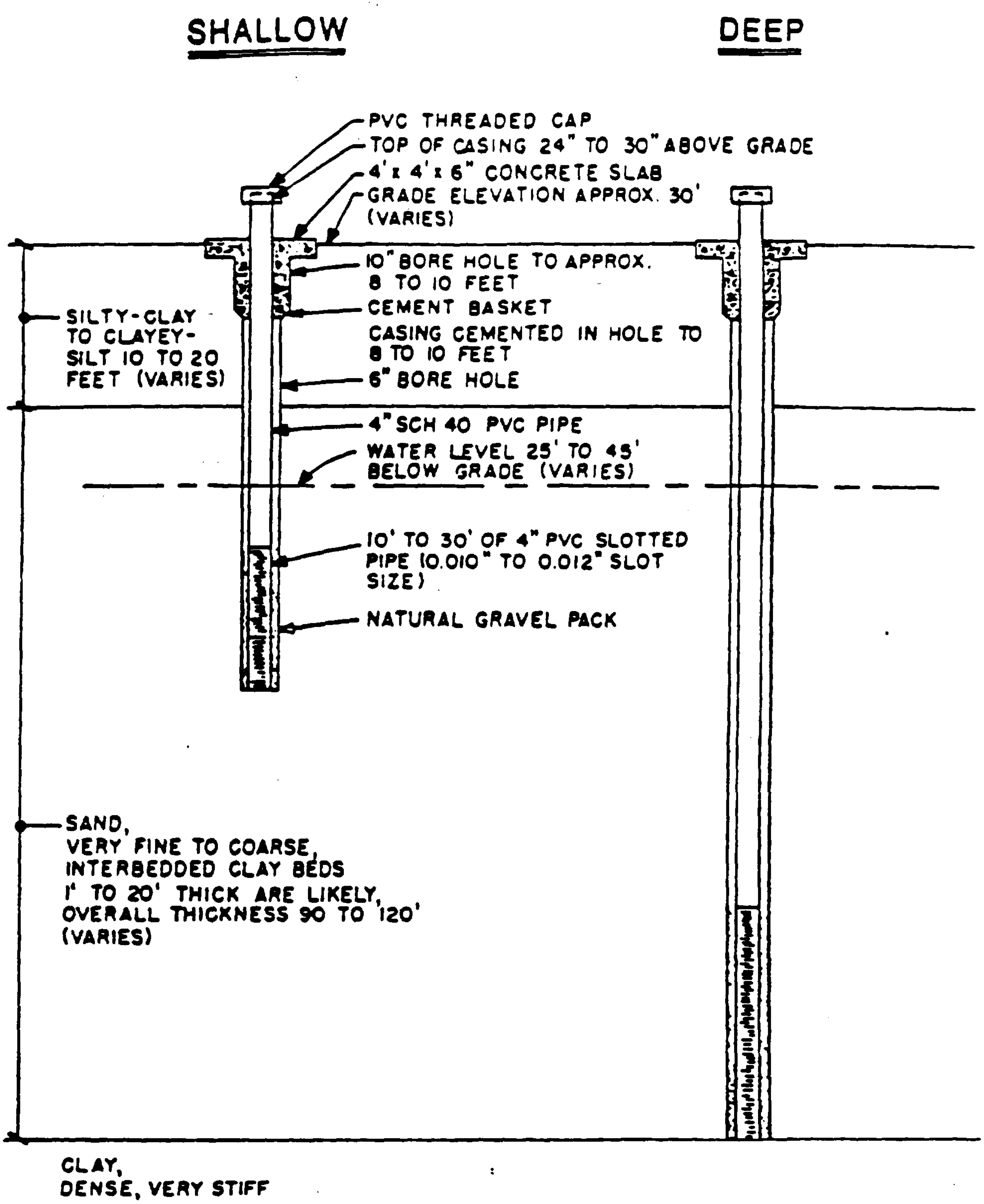


3 10 00268

APPENDIX XII

WELL CONSTRUCTION DATA, EXISTING WELLS

2468G G361-740



CAMP DRESSER & McKEE INC.

TYPICAL OBSERVATION WELL DESIGN

STAUFFER CHEMICAL COMPANY

MOBILE COUNTY, ALABAMA

FIGURE A-1

§Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
0-1*	§ S.1940. E.1510.	? Prior to 1973	4"O.D. Steel	(G) 33.	34.68	?	?	*Old Well - No construction details available. Data approximate.
0-2*	S.2394.7 E.1558.1	? Prior to 1973	4"O.D. Steel	33.76	34.97	?	?	*Old Well - No construction details available. Data approximate.
.0-3*	S.2577.40 E.1173.02	? Prior to 1973	2" PVC	37.16	39.44	105 Approx.	100-105 (Estimated)	*Old Well - Construction details approximate. 5' long 2" PVC screen.
0-4	§ S. 65.91 E. 794.85	04-05-73	3" PVC	31.61	32.14*	140	18-118	*Reference Pt. on top of broken casing. Has been broken further and covered with Dresser coupling and fittings.
0-5	N. 677.8 W. 823.7	04-06-73	3" and 4" PVC	32.60	34.92	120	97-117* 30-74**	*3" slotted PVC pipe **9-5' long sections of 4" ribbed PVC well screen (I.D. approximately 3-1/2")
0-6	S.2574.9 E.0019.6	04-09-73	4" * PVC	41.10	42.96	136	52-128*	*15-5' Long Sections of 4" ribbed PVC well screen (I.D. Approximately 3-1/2"). Well sampler(?) Jammed in well screen cannot get below about 70 ft.
.0-7	S.2372.7 E.1922.8	04-10-73	4" * PVC	39.69	41.42	134	35-45* 50-65 70-85 90-105 110-125	*14 - 5' long sections of 4" ribbed PVC well screen (I.D. approx. 3-1/2").
.0-8	N. 902.70 W. 14.00	05-02-73	4"* PVC	32.86	34.73	122	100-115*	*3-5' Long Sections of 4" ribbed PVC well screen (I.D. approximately 3-1/2")
0-9* Renumbered IM-1 by Cold Creek in 1983	§ S. 2.71 E. 577.72	05-07-73	6" Steel cemented in 12" hole to 120' 4" steel and 4" PVC	(G)33.1	34.8	461	207-227	*Well does not monitor aquifer(s) above "Blue Clay" Installed as a monitor well for injection well INJ-1, to monitor first aquifer below blue clay. 20' of 4" dia. slotted PVC pipe on 206 of 4" galvanized steel pipe.
0-10*	§ N. 141.96 E. 750.85	05-09-73	4" PVC	30.38	33.88	[illegible]	30-60	*Well was in the way of construction activity. [illegible] and abandoned by Stauffer Construction Fall Wint. [illegible]

3 10 00271

§Coordinates not Established by James H. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
0-12[a]	§ S. 631.71 E. 878.16	05-10-73	4" PVC	31.88	33.75[a]	60	28-58	[a]Top of PVC casing bent & crimped by tractor lawn mower in or prior to 1981.
0-13[a]	§ S. 409.89 E. 666.84	05-10-73	4" PVC	31.89	33.91	60	30-60	[a]Well was in the way of construction activity. Plugged and abandoned by Stauffer Construction in 1974 or 1975.
.0-14 Renumbered (CCM-8) by CCOP 1984	N. 922.67 E.1240.20	05-14-73	4" PVC	Bolt set in slab 29.89	31.80	120	89-109[a]	[a]4-5' long sections of 4" ribbed PVC well screen (I.D. approx. 3-1/2")
0-15[a]	§ N. 590[a] E. 635	06-25-73	4" PVC	25.87	28.70	90	54-84	[a]Coordinates approximate. Well was in the way of construction activity. Plugged and abandoned by Cold Creek Plant in 1981.
.0-16 Renumbered (CCM-9) by CCOP 1984	N.1156.52 E. 379.11	06-26-73	4" PVC	25.35[a]	30.87[a]	130	32-72	[a]Conc. slab covered by several feet of fill. Casing was extended.
0-17	N. 200.3 W.1293.2	06-27-73	4" PVC	36.30	38.95	129	16-86 106-116	[a]Bottom of well approx. 12' higher than planned.
0-18	S.1655.2 W. 632.7	06-28-73	4" PVC	42.56	45.17[a]	140	74-115	[a]Top of casing changed. New elevation is given. Old elevation was 45.27
0-19[a]	§ S.1210[a] E.1150	07-02-73	4" PVC	(G) 29.6	32.5[a]	122	60-120	[a]Coordinates & elevation data approximate. Well was in the way of construction activity. Plugged and abandoned by Stauffer Construction in 1974.
0-20[a]	S.2510 E.1397	07-03-73	4" PVC	35.06	36.79	85	51-81	[a]Damaged by plant personnel trying to sample well. Casing pulled apart in Jan. 1977.
0-20R[a]	S.2515 E.1385	01-7-77	4" PVC	34.49	36.42	86	Approx 55 to 85?	[a]Replacement well 0-20R drilled under plant supervision. Well was to duplicate Well 0-20, but no construction details were recorded.
.0-21 Renumbered (CCM-10) by	S. 273.29 E.1533.19	07-03-73	4" PVC	28.17	30.76	120	57-117	

3 10 00272

$Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
. Indicates Newer Elevation Data Based on Corrected (Adjusted) Base Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
0-23	$ N.1489.68 E.6727.79	07-10-73	4" PVC	13.29	11.67	80	38-58 *	*Coordinates approximate. Bottom of casing at approximately 79'. 20' of blank pipe below screen
0-24	$ N.1651.27* E.8521.10	07-11-73	4" PVC	13.83	11.94 *	63	42-62	*Coordinates approximate. Top of casing was changed. New elevation given. Older elevations were 14.33 until 9/8/78. Then 13.90 from 9/8/78 until April-May 1984.
0-25	S. 999.3 W. 504.3	10-27-73	4" PVC	44.60	47.24	131	108-128	
0-26 Renumbered (CCN-11) by CCOP 1984	S. 296.6 W. 485.1	10-27-73	4" PVC	45.42	46.85	133	50-90 110-130	
0-27	S. 274.5 W. 710.8	02-08-74	4" PVC *	45.06	45.82	137	119-134	3-5' long sections of 4" ribbed PVC well screen. (I.D. approx. 3-1/2).
0-28* Renumbered IM-2 by Cold Creek in 1983	$ N. 899.67 E. 315.00	03-25-75	6" steel cemented in 12" hole to 122 ft. 4" steel to 580'	(G) 31.3	Measuring Point 34.28	610	580-590	Well does not monitor aquifer(s) above "Blue Clay". Installed as a monitor well for injection well INJ-2, to monitor aquifer at about 560 to 610'. Has 10' SS well screen. Well is under slight pressure - about 15 psig at surface. Well is equipped with valve and pressure gauge.
0-29	S.2346.3 E.1660.2	08-30-77	4" PVC	33.52	35.64	90	58-88	
0-30	S.2410.4 E.1677.0	07-30-77	4" PVC	34.15	35.96	126	97-117	
0-31	S.2407.9 E.1498.8	07-29-77	4" PVC	36.37	38.62	126	98-118	
0-32	S.2342.4 E.1111.2	08-02-77	4" PVC	32.99	35.66	[illegible]	98-118	
0-33	S.2509.9 [illegible]	08-02-77	4" PVC	36.18	37.59	[illegible]	45-125	

$Coordinates not Established by James W. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
0-35	S.2468.4 E. 929.9	08-05-77	4" PVC	37.62	39.55	132	109-129	
0-36	S.2323.3 E.1830.3	06-21-78	4" PVC	38.37	40.56	131	108-128	
0-37	S.2333.6 E.1836.2	06-22-78	4" PVC	38.45	40.75	95	74-94	
.0-38	S.2200.0 E.1675.9	06-20-78	4" PVC	30.45	32.53	123	99-119	
.0-39	S.2203.2 E.1690.1	06-23-78	4" PVC	30.11	31.77*	92	69-89	*Top of casing changed. New elevation is given. Old elevation was 32.81. Ref. old base.
0-40	S.1935.4 E.1499.5	06-26-78	4" PVC	33.05	34.87	124	99-119	
0-41	S.1947.0 E.1506.1	06-28-78	4" PVC	32.81	35.44	91	69-89	
0-42	S.1782.8 E.1485.3	06-29-78	4" PVC	38.59	40.76	131	109-129	
0-43	S.1770.2 E.1477.6	06-30-78	4" PVC	38.61	40.68	96	75-95	
0-44	S.2106.2 E.1300.1	07-13-78	4" PVC	33.16	35.44	125	99-119	
0-45	S.2110.4 E.1298.0	07-14-78	4" PVC	33.05	35.49	92	71-91	
0-46	S.1060.2 E.1080.8	07-19-78	4" PVC	37.11	39.27	127	106-126	
0-47	S.1051.9 E.1094.5	07-20-78	4" PVC	37.07	39.79	92	71-91	
0-48	S,2105.8 E.1941.8	08-22-78	4" PVC	(G) 30.2	32.65	123	100-120	
0-49	S.2111.7 E.1910.0	08-23-78	4" PVC	(G) 30.5	31.19	81.5	59-79	

3 10 00274

§Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineerings & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
0-50 Renumbered COM-12 by Cold Creek in 1984	N. 326.2 E.3834.9	06-20-79	4" PVC	(G)38.9	41.38	117.5	105-115	
0-51	S. 354.6 E.4665.2	06-21-79	4" PVC	(G)45.1	47.27	119	98-118	
0-52	S.1001.6 E.4660.1	06-26-79	4" PVC	(G)45.2	47.51	117	96-116	
0-53*	S.1137.1 E.2160.2	11-26-79	4" PVC	33.70	35.61	125	104-123	*RCRA monitor well upgradient of brine mud pond SEP-201
0-54*	S.1140.6 E.2155.3	11-27-79	4" PVC	35.40 33.46	35.40	101	87-97	*RCRA monitor well upgradient of brine mud pond SEP-201
0-55*	S.1145.1 E.2140.8	11-27-79	4" PVC	32.71	34.39	57	46-56	*RCRA monitor well upgradient of brine mud pond SEP-201
0-56*	S.1622.4 E.2285.6	11-28-79	4" PVC	28.66	30.66	116.5	103-113	*RCRA monitor well downgradient of brine mud pond SEP-201
0-57*	S.1622.4 E.2273.3	11-29-79	4" PVC	27.55	29.84	99	78-98	*RCRA monitor well downgradient of brine mud pond SEP-201
0-58*	S.1621.0 E.2259.0	11-29-79	4" PVC	27.09	29.10	64	51-61	*RCRA monitor well downgradient of brine mud pond SEP-201
.0-59*	S.1261.5 E.2561.5	03-10-81	4" PVC	35.59	38.13	123	107-117	*RCRA monitor well upgradient of brine mud pond SEP-202
.0-60*	S.1261.5 E.2550.5	03-10-81	4" PVC	35.54	37.78	96	73-93	*RCRA monitor well upgradient of brine mud pond SEP-202
.0-61*	S.1261.5 E.2530.5	03-11-81	4" PVC	35.31	37.79	70	57-67	*RCRA monitor well upgradient of brine mud pond SEP-
.0-62*	S.1740.0 .2479.5	03-12-81	4" PVC	33.17	35.04	12[illegible]	104-114	*RCRA monitor well downgradient of brine mud pond [illegible]
.0 63*	S.1740.0	03-13-81	[illegible]	[illegible]				

§Coordinates not Established by James H. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
.0-64*	S.1790.0 E.2448.5	03-13-81	4" PVC	32.84	34.86	76	64-74	*RCRA monitor well downgradient of brine mud pond SEP-202
.0-65	S.2141.9 E.2237.8	03-16-81	4" PVC	33.98	36.01	80	68-78	
.0-66	S.2141.4 E.2252.5	03-14-81	4" PVC	34.70	36.83	120.5	97-117	
.0-67*	S.1027.43 E.1560.59	08-26-81	4" PVC	24.27	26.62	77	54-74	*RCRA monitor well upgradient of surge pond SEP-655
.0-68*	S.1028.18 E.1546.41	08-25-81	4" PVC	24.30	26.76	119	96-116	*RCRA monitor well upgradient of surge pond SEP-655
.0-69*	S.1263.09 E.1640.11	08-27-81	4" PVC	29.36	31.16	84	59-79	*RCRA monitor well downgradient of surge pond SEP-655
.0-70*	S.1259.32 E.1662.19	08-28-81	4" PVC	29.00	30.71	116	94-114	*RCRA monitor well downgradient of surge pond SEP-655
.0-71*	S.1335.51 E.1635.67	08-31-81	4" PVC	35.95	38.25	80	66-76	*RCRA monitor well downgradient of surge pond SEP-655
.0-72*	S.1304.91 E.1704.78	09-01-81	4" PVC	33.91	36.27	92	70-90	*RCRA monitor well downgradient of surge pond SEP-655
.0-73	S.1852.03 E.1856.49	09-02-81	4" PVC	31.44	33.92	93	70-90	
.0-74	S.1847.36 E.1868.97	09-03-81	4" PVC	31.52	34.19	120	98-118	
.0-75 Drilled as (M-1)	S.2537.76 E.1270.70	01-31-84	4" PVC	34.54	37.06	125	52-122	
.0-76 Drilled as (M-2)	S.2309.54 E.2097.01	02-01-84	4" PVC	31.94	34.27	114.5	54-114	
.0-77* Old No. was (LM-2 50:3M)	S.2235.8 E. 209.3	08-10-78	4" PVC	42.81	45.14	137	111-131	*Drilled as offset well for LM-2 for pumping test in August 1978. Renumbered as 0-77 in April 1985.

3 10 00275

3 10 00276

§Coordinates not Established by James H. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
.0-78§ Old Number was (LM-2-150SE)	S.2248.4 E. 382.9	08-11-78	4" PVC	41.60	44.17**	137	114-134	*Drilled as offset well for LM-2 for pumping test in August 1978, renumbered as 0-78 in April 1985 **Top of casing changed 4/12/84 - new elevation is given. Top of casing was broken again in March 1985
.0-79§ Old Number was IM-2	S.1095.61 W. 205.18	08-21-80	4" PVC	41.92	44.32	80	68-78	*Drilled as IM-2 in August 1980. Renumbered as 0-79 in April 1985.
.0-80§ Old Number was IM-1	S.1095.61 W. 189.67	08-20-80	4" PVC	41.76	44.08	132	98-118	*Drilled as IM-1 in August 1980. Renumbered as 0-80 in April 1985.

3 10 00277

§Coorindates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
.COH-1	S.687.92 E.990.53	08-22-80	4" PVC	26.23	28.49	76	61-71	
.COH-2	S.679.62 E.906.84	08-25-80	4" PVC	29.68	32.07	69	55-65	
.COH-3	S.660.47 E.890.78	08-26-80	4" PVC	30.41	32.79	119	97-117	
.COH-4	S.696.52 E.787.16	08-27-80	4" PVC	37.91	40.29	80	59-79	
.COH-5	N.806.01 E.480.14	08-28-80	4" PVC	25.87	28.45	74	60-70	
.COH-6	N.806.32 E.492.68	08-28-80	4" PVC	25.71	28.04	111	98-108	
.COH-7	N.841.64 E.823.34	08-29-80	4" PVC	29.80	33.23	73	59-69	
IM-1* (0-9)	§ S. 2.71 E.577.72							*Listed under well 0-9
IM-2* (0-28)	§ N.899.67 E.315.00							*Listed under well 0-28
.IM-3	S.881.87 E.543.37	07-28-83	4" PVC	43.25	45.59	85	68-78	
.IM-4	S.867.09 E.543.11	08-01-83	10 3/4" O.D. steel cemented in 15" hole to 137'. 4" PVC in 9 7/8" hole.	43.23	45.31	242*	208-228	*Well does not monitor aquifers above blue clay. Installed as a monitor well for injection well INJ-3 to monitor aquifer at 208 to 228 feet.
.IM-5	S.852.13 E.543.15	08-16-83	10 3/4" O.D. steel cemented in 15" hole to 115'. 4 1/2" O.D. steel cemented in 9" hole to 1134'	43.24	45.53	1204*	1140-1160	*Well does not monitor aquifer(s) above blue clay. Installed as a monitor well for injection well INJ-3 to monitor sand above the Bucatunna clay. Well is under slight pressure at surface. Is equipped with valve and gauge.

3 10 00278

$Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Old Elevation Data

WELL NUMBER	STAUFFER$ COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
.IM-6	N. 900.29 E. 418.36	08-17-83	10 3/4" O.D. steel cemented in 15" hole to 115'. 4" PVC in 9 7/8" hole.	27.52	30.00	250*	222-242	*Well does not monitor aquifer(s) above "blue clay" installed as a monitor well for injection well INJ-2.
.IM-7* Also numbered CC-12 by Cold Creek in 1981	S. 69.2 W.1435.8		Double cased well. See under CC-12.					*See listing under CC-12.

3 10 00279

§Coordinates not Established by James H. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Old Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
.CNAM-1§	S.2790.6 E.2592.7	1983	4" PVC	35.26	37.25	Approx. 70	60-70 (Estimated)	*Monitor Well #1 drilled by Vester Thompson (?) for Courtaulds. Renumbered CNAM-1 and measurement made by WPS February-May, 1984.
.CNAM-2§	S.2241.3 E.2871.0	1983	4" PVC	43.04	45.45	Approx. 70	60-70 (Estimated)	*Monitor Well #2 drilled by Vester Thompson (?) for Courtaulds. Renumbered CNAM-2 and measurement made by WPS February-May, 1984.
.CNAM-3§	S.3158.0 E.3881.3	1983	4" PVC	46.15	48.01	Approx. 70	60-70 (Estimated)	*Monitor Well #3 drilled by Vester Thompson (?) for Courtaulds. Renumbered CNAM-3 and measurement made by WPS February-May, 1984. Discovered that there is no bottom cap in this well - or screen is broken.
CNAM-21§ was CNA-1-75' NW.	S.2429.4 E.2082.6	08-19-78	4" PVC	(G) 36.1	39.00	130	106-126	*Drilled as offset well for CNA-1 for pumping test in August 1978. Renumbered as CNAM-21 in July 1984.
.CNAM-22§ was CNA-1-150' SW.	S.2600.7 E.2082.1	08-21-78	4" PVC.	(G) 38.8 Old base. S. 39.57	41.77	130	106-126	*Drilled as offset well for CNA-1 for pumping test in August 1978. Renumbered as CNAM-22 in July 1984.
.CNAM-23§ (M-3)	S.2331.15 E.2365.96	02-09-84	4" PVC	34.06	36.34	119	67-117	*Coordinates were for stake prior to drilling. Drilled as M-3.
.CNAM-24§ (M-4)	S.2609.84 E.1395.10	02-07-84	4" PVC	36.60	38.94	127	55-125	*Coordinates were for stake prior to drilling. Drilled as M-4.
.CNAM-25§ (M-5)	S.2756.57 E.1450.39	02-02-84	4" PVC	41.29	43.18	131	69-129	*Coordinates were for stake prior to drilling. Drilled as M-5.
.CNAM-26§ (M 6)	S.2500.48 E.1724.49	02-08-84	4" PVC	36.63	38.75	126	63-83 and 93-123	*Coordinates were for stake prior to drilling. Drilled as M-6.
.CNAM-27§ (M-7)	S.2689.49 E.1701.61	02-06-84	4" PVC	44.13	45.69	132	81-131	*Coordinates were for stake prior to drilling. Drilled as M-7.
.CNAM-28§ (M 8)	S.2600.16 E.2097.04	02-10-84	4" PVC	39.40	41.81	71	49-69	*Coordinates were for stake prior to drilling.

3 10 00280

$Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
.CNAM-30$ (M-10)	S.2730.74 E.1154.74	04-04-84	4" PVC	38.99	41.26	132	108.5-128.5	$Coordinates were for stake prior to drilling. Drilled as M-10.
.CNAM-31$ (M-12)	S.2564.85 E.1564.41	04-05-84	4" PVC	35.45	37.61	87.5	76.5-86.5	$Coordinates were for stake prior to drilling. Drilled as M-12.
.CNAM-32$ (M-11)	S.2550.46 E.1559.04	04-05-84	4" PVC	35.66	37.99	121	94-114	$Coordinates were for stake prior to drilling. Drilled as M-11.
.CNAM-33$ (M-13)	S.2469.61 E.1885.45	04-06-84	4" PVC	42.41	44.72	96	74-94	$Coordinates were for stake prior to drilling. Drilled as M-13.
.CNAM-34$ (M-14)	S.2479.80 E.1890.40	04-06-84	4" PVC	42.47	45.00	128.5	107-127	$Coordinates were for stake prior to drilling. Drilled as M-14.

3 10 00281

§Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
LM-1*	§ S.1234 E.1445.5	10-07-52	Double cased well by Layne. 24" outer casing 16" inner casing 12" screen.	(G) 38 Conc. pump foundation - just above grade.	?	144	?	*Well plugged and abandoned prior to 1973.
.LM-2	S.2197.9 E.242.3	07-08-52	Double cased well by Layne. As Above.	46.23 S.W. Bolt on discharge head. (45.99 pump foundation old elev. base)	46.70 South 1" dia. pipe within discharge head.	132	105-125	*Well was recompleted in 1975. 25' long 10" dia. stainless steel well screen was set inside the original 12" well screen.
LM-3*	S.1160.9 E.2345.1	01-06-56	Double cased. well by Layne. As above.	35.87 Conc. pump foundation	—	132	?	*Well abandoned in 1973 or before. Pump and motor have been removed. Steel plate covers top of casing.
LM-4*	§ S.1016.24 E. 660.2	? Spring 1965	Double cased well by Layne. As above.	25.38 Conc. pump foundation	26.16 Top of 4" pipe welded into steel cover plate	?	?	*Well abandoned - never in service. Pump and motor were pulled and installed in well No. LM-5 in June 1965.
.LM-5*	S.1199.5 E. 150.4	06-15-65 (?)	Double cased well by Layne. As above.	41.94 S.E. corner conc. pump foundation	44.09 S.E. corner of cast steel sole plate.	125.6 Below top of pump base meas. in Aug.	94-124 Below top of pump foundation (approximated in Aug. 1983).	*Well was recompleted in August 1983, after well was pumping gravel pack. Installed 30' of 8" dia. stainless steel well screen inside the original 12" well screen.

3 10 00282

§Coordinates not Established by Garratt Engineers
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONST.	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
LN-6	S. 713.6 E.3150.0	Aug. 1965	Double cased well by Layne. As above.	44.18 Conc. pump foundation just above grade.	—	131	88-118	
LN-7	S.2376.8 W.1453.0	May 1972	Double cased well by Layne. As above.	40.98 Conc. pump foundation	— *	120	93-123*	*Screen interval of 93-123 was given to me, but I suspect 103-120 is more likely to be correct. (W.P.S.)
CC-8*	§ S.265.33 E. 0.00	01-11-66*	Double cased well by Layne. As above.	(G) 42.6	— *	137	68-83 ** 117-127	*Well was plugged and abandoned about 1980. **Well was completed in two acquifiers. Both above "Blue Clay" unit.
CC-9*	§ S.412.22 W.940.77	01-05--69 *	Double cased well by Layne. As above.	(G) 44.44	44.46 Metal plate covering well.	139	74-89 ** 119-129	*Well was plugged and abandoned about 1980 (?). **Well was completed in two aquifers, both above "blue clay" unit.
LN-10	S.1290.4 W.1306.3	Dec. 1973	Double cased well - modified Layne type well. By Holland well.	43.91 S.W.' bolt on discharge head.	—	134	114-134	
.CC-11	N.474.6 W.468.4	04-22-75	Double cased* well-modified Layne type well by Holland.	39.57 N.W. bolt in adapter plate (almost grade).	39.61 Top side of (N.W. corner) lower flange on discharge	127	115-125	*Well was recompleted in 1978 - smaller dia. inner casing and screen also lower capacity pump purchased.

3 10 00283

§Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
.OC-12* Also numbered IM-7 by CCDP in 1983	S. 69.2 W.1435.8	12-05-78*	24" steel cemented in 30" hole to 71'. 14" steel inner casing with 12" SS screen in 30" hole. **	33.85 Sole plate.	33.97 Top side of flange on base of discharge head.	122	98-118	*Well originally drilled as TW-12 in 8/25/77. **Completed as production well Nov.-Dec. 1978. ***Recompleted as production well in March 1981. Set smaller well screen inside existing screen to reduce or eliminate sand pumping.

$Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
.IW-1	S.2314.13 E.2017.23	06-18-80	Double cased well 30" steel casing cemented in 36" dia. hole to about 65'. 24" steel inner casing with 24" dia. stainless steel well screen.	36.37 N.W. bolt on discharge head.	36.41 Top of 1/2" PVC measuring tube (West Side)	119	69-119	Ground water intercept well designed by Ground Water Associates, Inc. and Stauffer Geology, on line December 1980.
.IW-2	S.2403.12 E.1696.88	06-20-80	Double cased well as above.	37.01 S.E. bolt on discharge head.	37.06 Top of 1/2" PVC measuring tube (East Side)	122	72-122	Ground water intercept well, (as above).
.IW-3	S.2506.90 E.1166.33	06-25-80	Double cased well. As above	35.97 S.E. bolt on discharge head.	36.01 Top of 1/2" PVC measuring tube (East Side)	124	74-124	Ground water intercept well, (as above).

$Coordinates not Established by James N. Garratt & Assoc., Inc. (consulting engineers & land surveyors)
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base
Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONSTRUCTION	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
INJ-1*	$ N. 70.38 E.765.02	Feb. 1969	Deep waste injection well.	(G) 30	—	4330	3402-3491 Injection zone (Ref. Kelly Bushing)	*Plugged and abandoned April 1984.
.INJ-2	N. 960.43 E. 409.96	June 1974	Deep waste injection well.	28.82	—	4601	4450-4600 Injection zone.	
.INJ-3	S. 875.13 E. 625.55	Jan. 1983	Deep waste injection well.	44.49	—	4750	4415-4515 Injection zone.	

3 10 00286

§Coordinates not Established by Garratt Engineers
.Indicates Newer Elevation Data Based on Corrected (Adjusted) Base Elevation that is 0.2 Ft Lower Than Older Elevation Data

WELL NUMBER	STAUFFER COORDINATES	DATE COMPLETED	TYPE OF WELL CONST.	ELEVATION OF CONC. SLAB OR GRADE (G)	ELEVATION OF TOP OF CASING OR MEAS. PT.	TOTAL DEPTH OF HOLE	DEPTH OF SCREENED INTERVAL BELOW GRADE	COMMENTS
CNA-1*	S.2464.06 E.2148.97	1952	**	35.22	——	124	88-118	*Well abandoned. Pump and motor have been removed. Top of casing is covered with steel plate. **Double cased well by Layne 24" steel casing cemented in 30" hole to 80 ft. 16" inner casing with 12" screen.
CNA-2*	S.2840 ** E.1024	1952	***	45.64 Concrete pump foun. Top of foundation at grade.	——	133	97-127	*Well abandoned. Pump and motor have been removed. Top of casing is covered with steel plate. **Coordinates are approximate. ***Double cased well by Layne 24" steel casing cemented in 30" hole to 80 ft. 16" inner casing with 12" screen.
CNA-3	?	1952	*	?	?	131	95-125	*Double cased well by Layne 24" steel casing cemented in 30" hole to 80 ft. 16" inner casing with 12" screen.
.CNA-5	S.2090.44 E.3293.78	1955	*	43.17 (Base Plate)	43.91 (Top of 1" pipe cap holding air line).	130 Approx.	92-122	*Double cased well by Layne 24" steel casing cemented in 30" hole to 80 ft. 16" inner casing with 12" screen.

3 10 00287

APPENDIX XIII

TOPOGRAPHIC MAP

2468G G361-740

3 10 00288

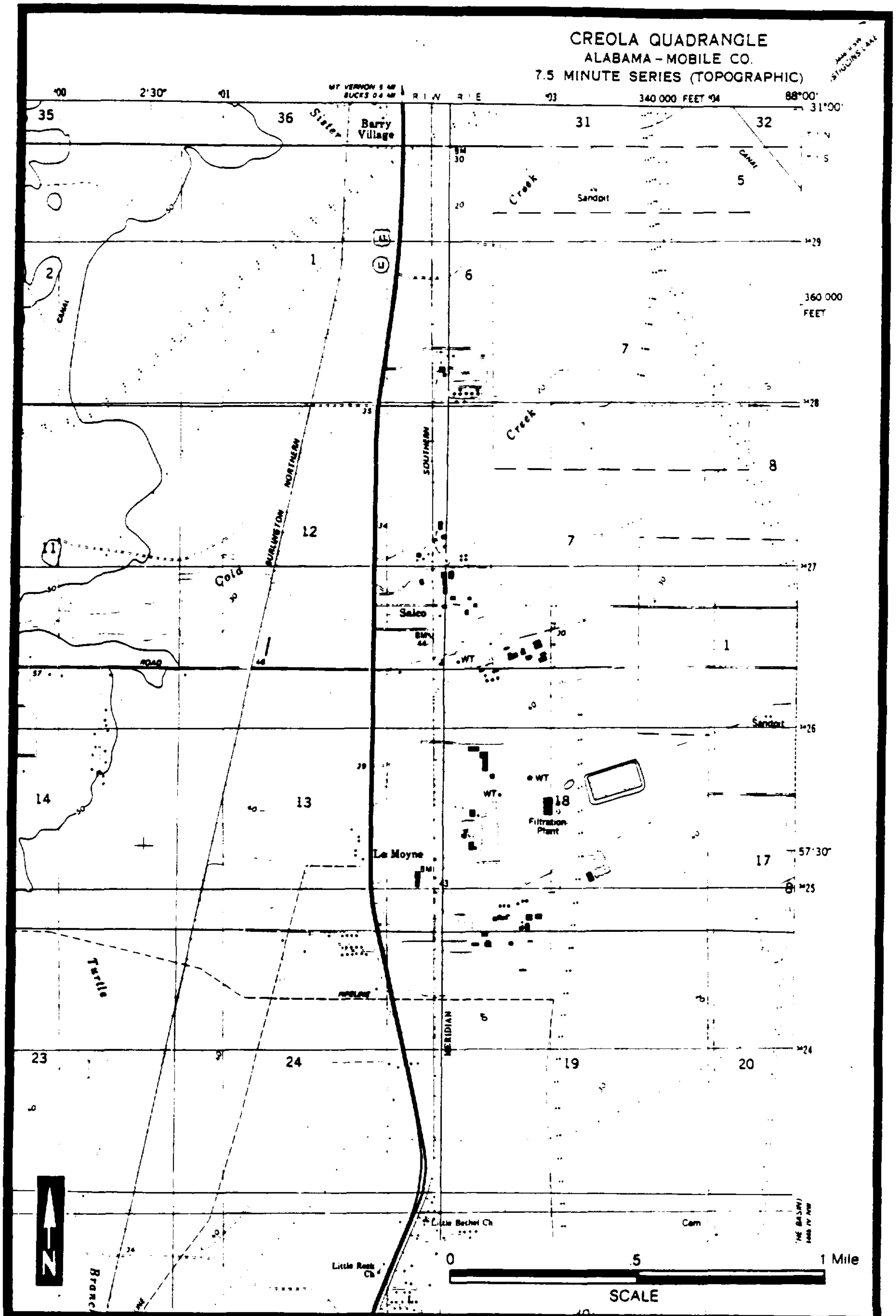


Figure 13-1 Topographic Map

APPENDIX XIV

WATER RESOURCES OF THE MOBILE AREA, ALABAMA

3 10 00290 Appendix XIV

UNITED STATES DEPARTMENT OF THE INTERIOR
Douglas McKay, Secretary

GEOLOGICAL SURVEY
Thomas B. Nolan, Director

GEOLOGICAL SURVEY CIRCULAR 373

WATER RESOURCES OF THE MOBILE AREA, ALABAMA

By W. H. Robinson, W. J. Powell, and Eugene Brown

With a section on salinity of the Mobile River by the
Corps of Engineers, U. S. Army, Mobile District

Washington, D. C., 1956

Free on application to the Geological Survey, Washington 25, D. C.

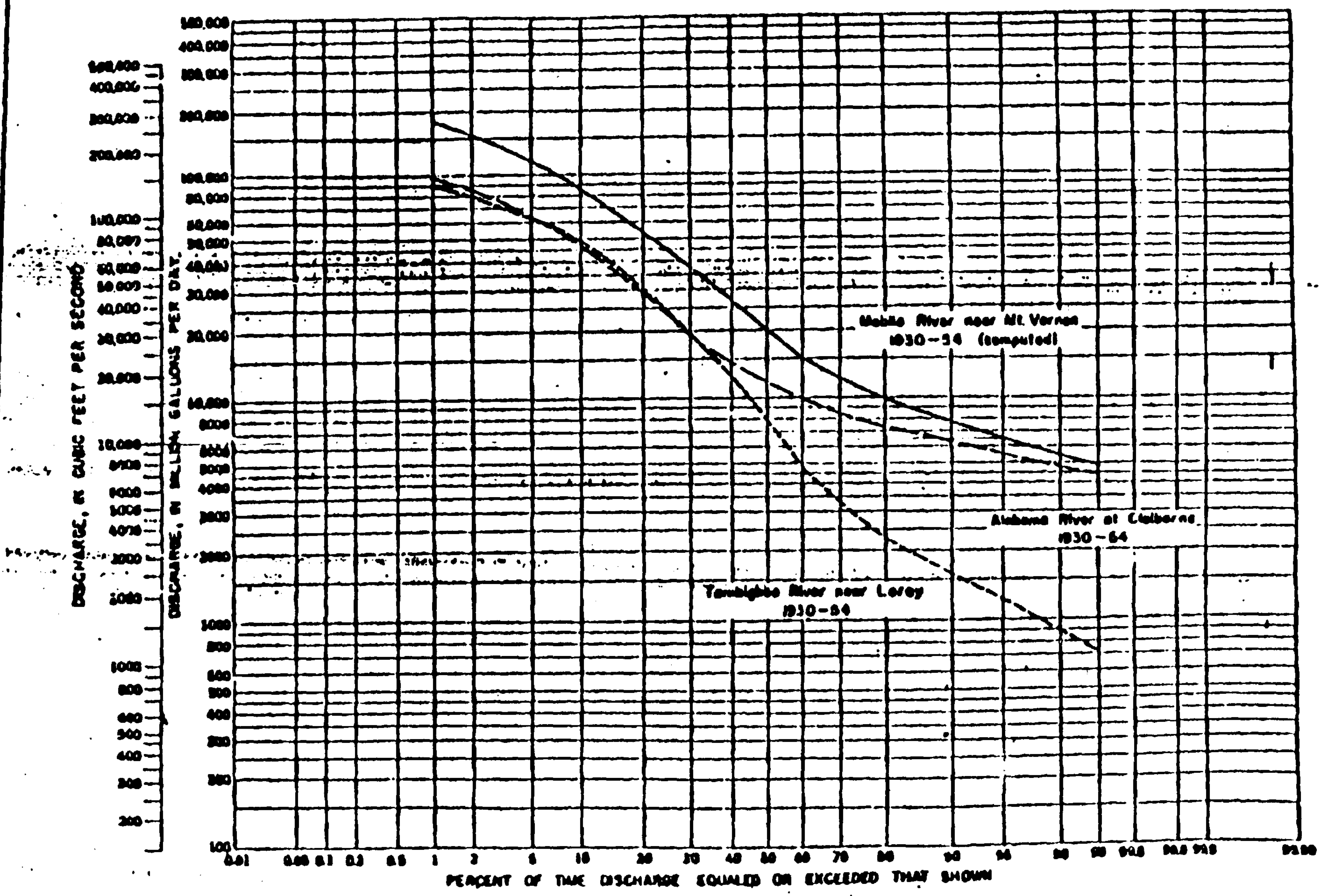


Figure 8.—Duration curve of daily flow, Alabama-Tombigbee-Mobile River system.

3 10 00291

3 10 00292

Table 3.—Probable duration of low flow at supplemental gaging sites in the Mobile area

Percent of time discharge indicated was equaled or exceeded	Discharge per square mile of drainage area							
	Bassett Creek near Wagerville (Water years 1939-54)		Lewis Creek near McIntosh (Water years 1939-54)		Bilbo Creek near McIntosh (Water years 1939-54)		Bates Creek near Calvert (Water years 1939-54)	
	cfs/sq mi	mgd/sq mi	cfs/sq mi	mgd/sq mi	cfs/sq mi	mgd/sq mi	cfs/sq mi	mgd/sq mi
70	0.47	0.30	0.40	0.26	0.40	0.28	0.37	0.24
80	.27	.17	.19	.12	.15	.10	.14	.090
85	.20	.13	.11	.071	.10	.066	.075	.048
90	.14	.090	.070	.045	.063	.041	.043	.028
93	.11	.071	.047	.030	.042	.027	.026	.017
95	.092	.059	.036	.023	.032	.021	.019	.012
97	.066	.043	.022	.014	.020	.013	.010	.0065
98	.053	.034	.015	.0097	.013	.0084	.0064	.0041
99	.034	.022	.0082	.0053	.0060	.0045	.0029	.0019

Percent of time discharge indicated was equaled or exceeded	Discharge per square mile of drainage area							
	Cedar Creek near Mount Vernon (Water years 1939-54)		Bayou Sara near Saraland (Water years 1939-54)		Eightmile Creek near Eight Mile (Water years 1939-54)		Threemile Creek near Crichton (Water years 1939-54)	
	cfs/sq mi	mgd/sq mi	cfs/sq mi	mgd/sq mi	cfs/sq mi	mgd/sq mi	cfs/sq mi	mgd/sq mi
70	0.53	0.34	1.1	0.71	1.9	1.2	1.6	1.0
80	.39	.25	.81	.52	1.7	1.1	1.4	.90
85	.32	.21	.68	.44	1.6	1.0	1.3	.84
90	.27	.17	.58	.38	1.5	.97	1.2	.78
93	.23	.15	.48	.31	1.5	.97	1.2	.78
95	.21	.14	.42	.27	1.4	.90	1.1	.71
97	.17	.11	.34	.22	1.3	.84	1.0	.65
98	.15	.097	.29	.19	1.2	.78	.95	.61
99	.12	.078	.21	.14	1.1	.71	.83	.54

channels, bayous, and lakes fill on a rising tide and empty on a falling one. The tidal effect is known to be sufficient at times to cause the Mobile River at Mount Vernon to flow upstream.

It has been generally recognized that the flow in the Mobile River is practically equal to the combined flow of the two headwater streams. Until recently more accurate definition of the pattern of flow did not appear to be warranted. Now, however, questions have arisen in connection with recent developments on the Mobile River that show the need for more nearly accurate information.

Discharge

In times of low flow the Alabama River is the major contributor to the Mobile River. Its naturally good low-flow characteristics are improved by considerable storage capacity at power-plant reservoirs on its headwater streams.

The Tombigbee River at the gaging station near Leroy has a drainage area comparable to the drainage area of the Alabama River at Claiborne. However, in periods of low water, the yield of this stream is much less than that of the Alabama River. Some regulation is afforded over the low flows in the stream by the navigational locks and dams. It is expected that additional control will be exercised by the new lock and dam at Demopolis.

The annual runoff of the Mobile River is the combined runoff of the Alabama River at Claiborne and the Tombigbee River near Leroy, and a small runoff from the drainage area between the gaging stations and the confluence of the rivers. However, the flow of the Mobile River for any particular time can not be so easily related to the flow at the upstream gaging stations. Channel storage and tide have a substantial effect on the rate of flow of the Mobile River.

A gaging station was established on the Mobile River at Mount Vernon and operated for 1 year to make possible some appraisal of the flow characteristics of the Mobile River and evaluation of the relation between the combined flows at the upstream gaging stations and the flow in the Mobile River. This station was located about 2 miles above the division into the Tensaw River and the lower Mobile River on the reach of river where the flow is generally confined to one channel. Except during times of flood, the discharge at the station varied considerably during the daily tidal cycle. Negative, or upstream, flow occasionally occurred for a few hours on the right combination of high tides and low flows. Typical stage and discharge hydrographs for selected tidal cycles are shown in figure 6.

3 10 00293

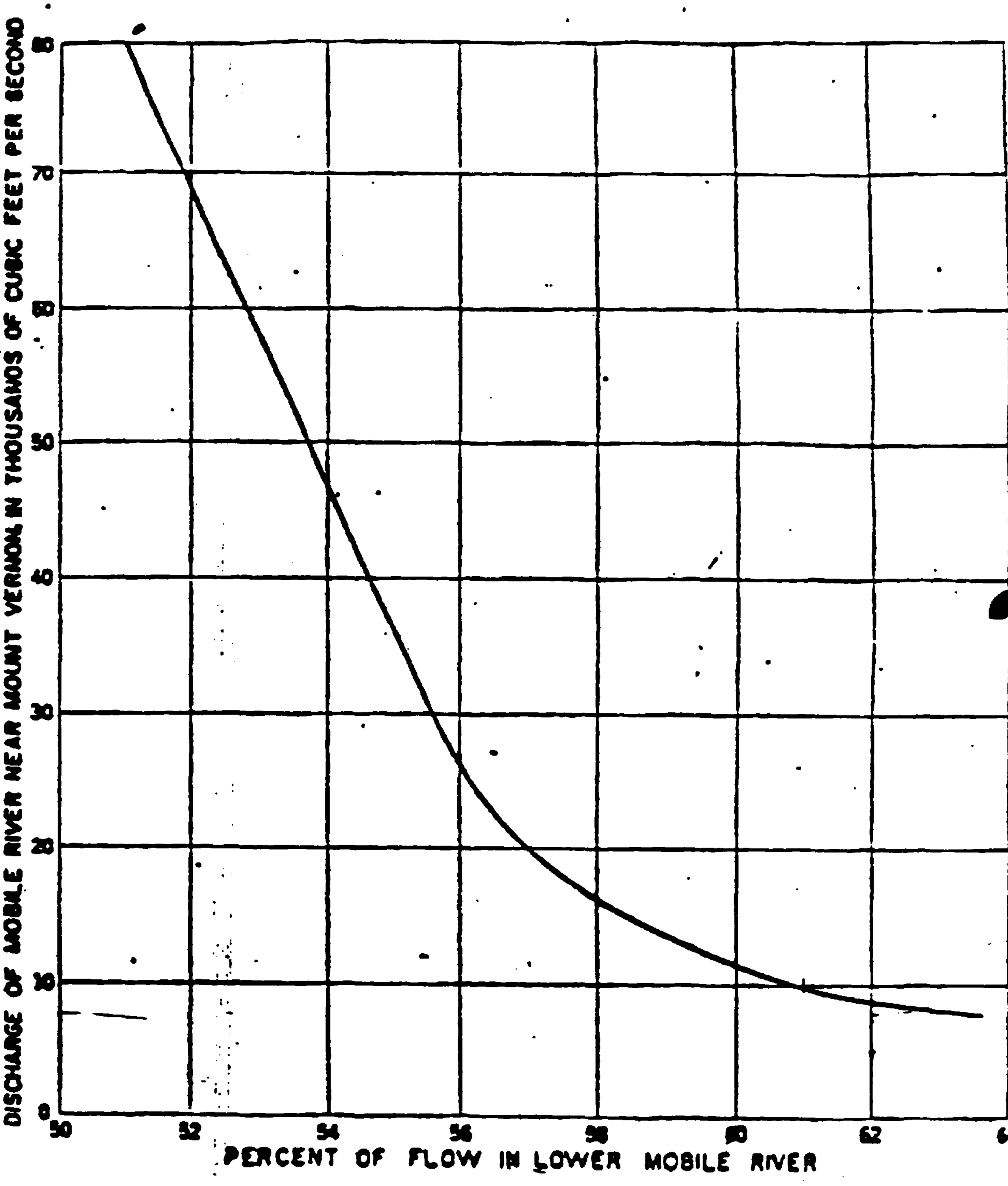


Figure 8.—Division of flow between Mobile and Tensaw Rivers.

tions, but they will be subject to the effect of water going into or coming out of storage on a generally rising or falling stage. Average discharges for the months from October 1953 through September 1954 are shown in figure 7. For comparison, the combined flow of the upstream stations is also shown in this figure. It is evident that a considerable amount of water is retained in storage on a generally rising stage and is released on a generally falling one. For this reason, months of high average flow are not always closely comparable to the combined flows of the upstream stations. On the other hand, the monthly averages for periods of low flow appear to be quite closely comparable to the monthly average of the combined flow, especially if the combined flow is corrected for the inflow in the intervening area between gaging stations

Figure 7.—Monthly discharge, Mob... ...ver near Mount Vernon.

·3 10 00294

Duration of flow data for the Mobile River at Mount Vernon are shown in figure 5. The maximum, minimum, and median values of the average discharge for each month for the combined flows of the upstream stations for the period 1930 to 1954 are shown in figure 7. As occurrences in the past are indications of occurrences in the future, the diagram can be used to estimate the probable range of conditions that may be generally expected.

* The Mobile River first divides into the Tensaw and lower Mobile Rivers. The flow in these two streams is about equally divided at bankful stage, but at lower stages the more efficient channel of the lower Mobile River carries an increasingly larger proportion of the total flow (fig. 8). Although this relation is believed to be reliable for mean daily flows, it is not necessarily reliable if used for average flows for shorter periods or for estimating the division of flow for any particular instant, especially when varying tidal effects occur within a tidal cycle. Once, for a short period, water was known to flow simultaneously up the Tensaw River and down the lower Mobile River.

The Tensaw River divides several times before it empties into Mobile Bay. No information is available on the distribution of flow at these divisions. The Mobile River does not divide further until just north of the metropolitan area, nor do any streams of appreciable size flow into this reach.

Floods

Not much information is available on floods in the Mobile River. Large floods occurred in 1929, 1938, and 1948. Information is available on these floods at the upstream gaging stations, but because the flood flows were mostly confined to the uninhabited swampland little information is available about them on the Mobile River. Water-surface profile data on a lesser flood in April 1951 were obtained from the Corps of Engineers and are shown in figure 9. For comparison, a reported water-surface elevation of the 1929 flood at the Mount Vernon gaging station and the approximate elevation of the 25-year flood are shown in the same figure. A "25-year flood" is a flood of the magnitude that would be equaled or exceeded on the average of once in 25 years.

Floods of another type occur on the lower reach of the Mobile River when strong winds from the Gulf of Mexico cause the water of Mobile Bay to pile up at the head of the bay. When these winds reach the velocities attained in the infrequent hurricanes, the piling up of water floods low-lying areas in the city. The most destructive hurricanes of this century occurred in September 1906 and in July and October 1916. The July 1916 storm is reported to have produced a tide of 11.6 feet above mean sea level at Mobile.

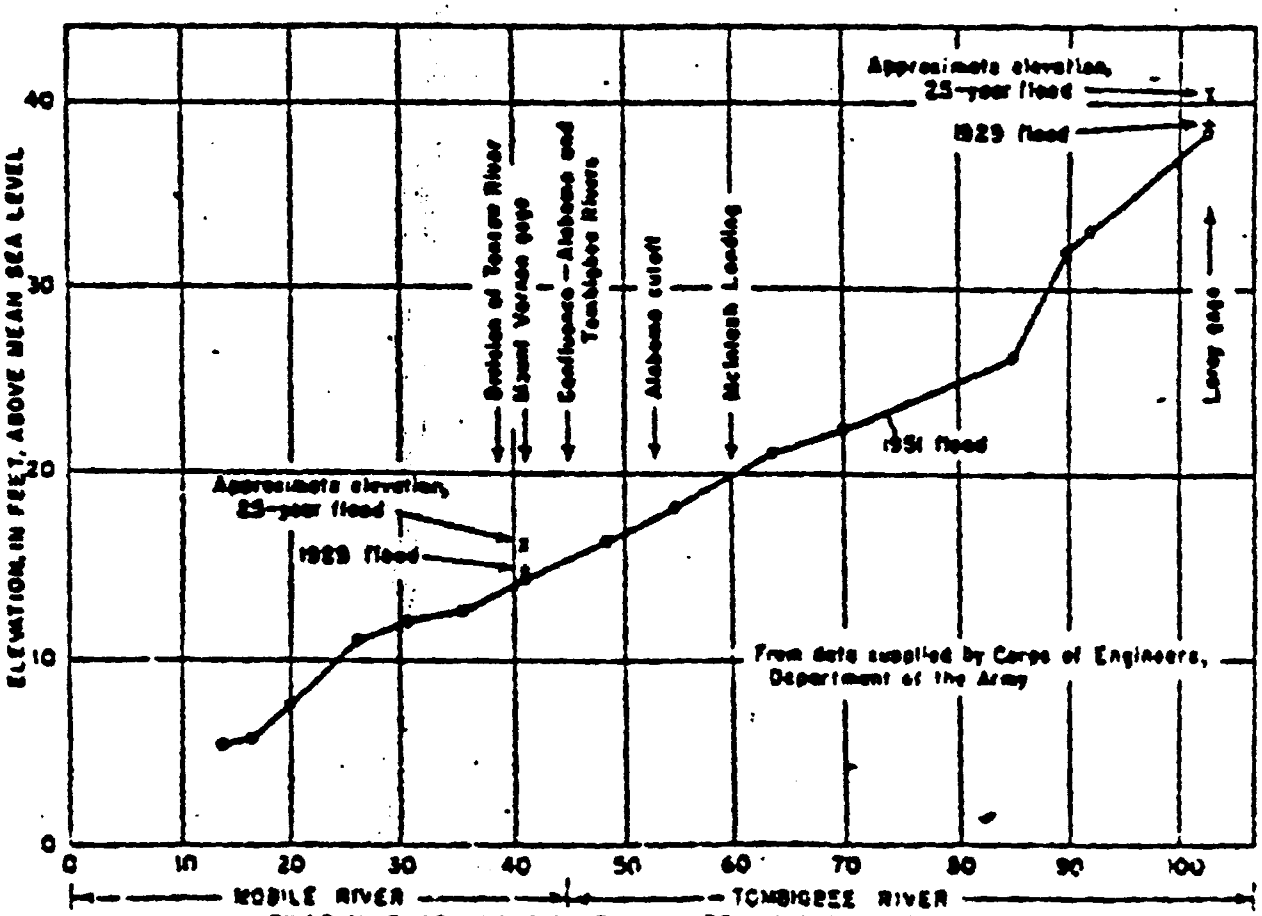


Figure 9.—Profile of April 1951 flood on Mobile River.

3 10 00295

2-4705 MOBILE RIVER NEAR MOUNT VERNON ALA
LOCATION--LAT 31 06 50 LONG 87 58 05 IN SE 1/4 SEC 41 T2N R1E AT BOAT PIER ON
WEST BK OF LAKE DAVID .5MI US FR LAKE OUTLET TO MOBILE: RV 2.5MI NE OF MT VERNON
• AT MILE 41.3 FR MOBILE /DRAINAGE AREA---43000 /RECORDS AVAILABLE---OCT 1953
TO SEPT 1954 / GAGE---STAGE RECORDER DATUM ABOUT 2FT BELOW MSL BY COMPARATIVE
GH READINGS AUX GAGE AT ALA ST DOCKS
THRU 1967 MOUNT VERNON FLOW =(CLAIBORNE FLOW + MV 4/3 FLOW) * 1.05
AFTER 1967 MOUNT VERNON FLOW =(CLAIBORNE FLOW + COFFEEVILLE FLOW) * 1.07
MONTHLY AND YEARLY DISCHARGE IN CUBIC FEET PER SECOND

W.Y.	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	THE YEAR
1928											26500.0	20200.0	
1929	20500.0	20700.0	23400.0	45000.0	90300.0	347600.0	146700.0	132300.0	36200.0	87000.0	20200.0	20000.0	77700.0
1930	24000.0	104600.0	103600.0	71800.0	98900.0	117500.0	53700.0	54300.0	40000.0	16000.0	10400.0	23000.0	65100.0
1931	10100.0	54300.0	30600.0	80000.0	42300.0	55100.0	73500.0	34600.0	15400.0	16400.0	19500.0	10400.0	36500.0
1932	9190.0	9120.0	74900.0	126600.0	100200.0	100800.0	83200.0	49000.0	25900.0	47400.0	26700.0	35400.0	63700.0
1933	67100.0	72800.0	175100.0	211000.0	161000.0	147000.0	138500.0	46000.0	21500.0	33900.0	21200.0	19500.0	91100.0
1934	16300.0	16200.0	21100.0	39400.0	31800.0	132200.0	47900.0	28200.0	33400.0	24000.0	31700.0	19100.0	37000.0
1935	56300.0	39000.0	41100.0	72400.0	73800.0	178700.0	116000.0	75300.0	29700.0	17800.0	10400.0	16300.0	61200.0
1936	12000.0	21100.0	27000.0	184500.0	220100.0	59900.0	184200.0	30600.0	19300.0	24000.0	26500.0	15500.0	68000.0
1937	16200.0	14900.0	34400.0	177000.0	165400.0	104700.0	85900.0	123300.0	25300.0	19500.0	16600.0	30500.0	66600.0
1938	28900.0	34100.0	30100.0	53200.0	46300.0	98300.0	302000.0	43300.0	34900.0	41600.0	41400.0	17600.0	64200.0
1939	12200.0	14700.0	15200.0	42000.0	131400.0	168700.0	89400.0	30100.0	89900.0	31100.0	115700.0	27400.0	63600.0
1940	10500.0	15100.0	10900.0	45900.0	120700.0	105500.0	84500.0	40500.0	34300.0	141900.0	25600.0	15000.0	56700.0
1941	12500.0	19000.0	46000.0	54200.0	54100.0	81500.0	45800.0	20400.0	13000.0	41000.0	40500.0	15100.0	36900.0
1942	12400.0	14200.0	55100.0	51600.0	76900.0	143500.0	72800.0	25700.0	34300.0	22200.0	31700.0	19500.0	46500.0
1943	15800.0	15300.0	44000.0	123800.0	70100.0	153700.0	130200.0	30900.0	20400.0	23000.0	22800.0	16900.0	54300.0
1944	11600.0	17200.0	10500.0	45700.0	87700.0	172600.0	266900.0	126800.0	26200.0	17900.0	27500.0	21000.0	69700.0
1945	13100.0	14600.0	26300.0	46400.0	115100.0	165200.0	101300.0	92600.0	23900.0	21200.0	18000.0	13200.0	55700.0
1946	15300.0	18700.0	54000.0	205200.0	212700.0	172700.0	106800.0	91000.0	67300.0	54200.0	49300.0	32000.0	89400.0
1947	18800.0	46300.0	40800.0	195100.0	128000.0	132900.0	157100.0	73000.0	44200.0	33100.0	17200.0	15000.0	74800.0
1948	12100.0	39000.0	60000.0	46500.0	107600.0	214300.0	135900.0	28300.0	20200.0	23000.0	29400.0	16600.0	68100.0
1949	15100.0	78000.0	235100.0	204300.0	223500.0	125600.0	132500.0	103600.0	46200.0	50000.0	29400.0	32300.0	105700.0
1950	17000.0	24400.0	30700.0	101300.0	112500.0	134700.0	62800.0	52400.0	28400.0	35600.0	35300.0	69000.0	58400.0
1951	21300.0	23200.0	39200.0	68500.0	114200.0	102600.0	242900.0	45800.0	23200.0	22200.0	15300.0	14100.0	60400.0
1952	12600.0	22600.0	81800.0	91300.0	84000.0	145700.0	77100.0	34900.0	24000.0	12800.0	16800.0	12900.0	51400.0
1953	11200.0	11900.0	28600.0	100200.0	109800.0	150300.0	80500.0	144000.0	22700.0	27200.0	15000.0	12600.0	59500.0
1954	15500.0	13500.0	60900.0	70400.0	73800.0	61000.0	74000.0	34700.0	16400.0	11800.0	10500.0	9430.0	38100.0
1955	7610.0	9420.0	12500.0	47200.0	89800.0	72400.0	160100.0	40500.0	28900.0	27100.0	22200.0	10000.0	43400.0
1956	10100.0	14000.0	18300.0	13900.0	124100.0	137600.0	137800.0	38000.0	16800.0	24000.0	10400.0	11000.0	46000.0
1957	15400.0	12900.0	48700.0	49900.0	127800.0	79000.0	159000.0	51000.0	31500.0	29100.0	12600.0	21700.0	52400.0
1958	34900.0	93400.0	127700.0	65900.0	108900.0	142200.0	90200.0	105000.0	24000.0	58000.0	24800.0	25300.0	75100.0
1959	23400.0	19000.0	25900.0	56000.0	108400.0	83400.0	87900.0	37900.0	71100.0	18900.0	13800.0	17900.0	46600.0
1960	29900.0	32200.0	43300.0	83400.0	129800.0	155100.0	103000.0	30000.0	18600.0	13000.0	18000.0	15800.0	56500.0
1961	22100.0	21300.0	28500.0	37600.0	127900.0	335900.0	179400.0	46500.0	44200.0	51800.0	21200.0	22000.0	77800.0
1962	13800.0	22000.0	217600.0	203800.0	151700.0	143100.0	186900.0	38500.0	25400.0	19200.0	12500.0	15400.0	87200.0
1963	17800.0	23400.0	24100.0	68600.0	75800.0	124100.0	38000.0	70900.0	41900.0	46300.0	21000.0	13900.0	47100.0
1964	142[illegible]	13300.0	37700.0	84400.0	161600.0	210300.0	277100.[illegible]	[illegible]33500.0	23700.0	30500.0	24100.0	15600.0	88500.0

2-4705 MOBILE RIVER NEAR MOUNT VERNON ALA
LOCATION--LAT 31 06 50 LONG 87 58 05 IN SE 1/4 SEC 41 T2N R1E AT BOAT PIER ON
WEST BK OF LAKE DAVID .5MI US FR LAKE OUTLET TO MOBILE RV 2.5MI NE OF MT VERNON
+ AT MILE 41.3 FR MOBILE /DRAINAGE AREA---43000 /RECORDS AVAILABLE---OCT 1953
TO SEPT 1954 / GAGE---STAGE RECORDER DATUM ABOUT 2FT BELOW MSL BY COMPARATIVE
GH READINGS AUX GAGE AT ALA ST DOCKS
THRU 1967 MOUNT VERNON FLOW =(CLAIBORNE FLOW + MY 43 FLOW) * 1.05
AFTER 1967 MOUNT VERNON FLOW =(CLAIBORNE FLOW + COFFEEVILLE FLOW) * 1.07

MONTHLY AND YEARLY DISCHARGE IN CUBIC FEET PER SECOND

W.Y.	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	THE YEAR
1965	33600.0	26000.0	79300.0	88200.0	153200.0	130500.0	113000.0	21500.0	26400.0	20700.0	10700.0	17300.0	60800.0
1966	22900.0	15000.0	21900.0	40400.0	151000.0	129300.0	58900.0	106000.0	25200.0	16700.0	19000.0	20500.0	52500.0
1967	27000.0	37900.0	41200.0	58100.0	73400.0	50000.0	18400.0	40400.0	21900.0	52400.0	49600.0	44600.0	43000.0
1968	25500.0	49000.0	160400.0	200000.0	47000.0	83600.0	95600.0	70000.0	23000.0	27500.0	23000.0	13700.0	69500.0
1969	11700.0	17200.0	52400.0	71400.0	180400.0	84000.0	131900.0	79900.0	20700.0	10100.0	17000.0	21400.0	53000.0
1970	21500.0	16400.0	39600.0	72600.0	55400.0	127400.0	116700.0	67300.0	43900.0	14000.0	23700.0	10200.0	51400.0
1971	23400.0	27300.0	34600.0	75600.0	133800.0	247400.0	95900.0	79400.0	29200.0	34300.0	37300.0	29700.0	70400.0
1972	17200.0	16500.0	99700.0	202200.0	95300.0	116000.0	51300.0	43000.0	25000.0	26500.0	19200.0	10700.0	61100.0
1973	12700.0	26000.0	94400.0	167700.0	121900.0	172000.0	229600.0	141000.0	94900.0	40300.0	28000.0	19000.0	96200.0
1974	19200.0	28600.0	78200.0	207300.0	106000.0	75200.0	163200.0	53000.0	57700.0	25300.0	27200.0	54200.0	80500.0
TOTAL	909700.0	1358240.0	2729200.0	4458700.0	5263800.0	6265600.0	5587600.0	2944100.0	1516200.0	1440700.0	1211200.0	1006530.0	2874500.0
AVERAGE	19776.1	29527.0	59330.4	96920.3	114430.4	136208.7	121469.6	64002.2	32960.9	31319.6	25770.2	21415.5	62489.1

ROUND OFF AVERAGES TO 3 SIGNIFICANT FIGURES

3 10 00296

To Bill Cawthra Dobbs Ferry 5/2/77

3 10 00297 From E C Curran Cold Creek

ECC

Retn orig to ECC

MOBILE RIVER

BARRY STEAM PLANT AT BUCKS, ALA.

ANNUAL PEAK STAGES

Calendar Year	Date	Gage Datum	Elevation MSL	Estimated Discharge
1951	Apr	13.91	12.00	355,000
52	Insufficient record			
53	Feb 25	8.10	6.19	152,000
54	Feb 2	8.18	6.27	154,000
55	Apr 23	10.38	8.47	228,000
56	Mar 27	9.96	8.05	214,000
57	Apr 17	10.48	8.57	232,000
58	Mar 18	8.97	7.06	179,000
59	Feb	7.30	5.39	128,000
60	Mar 22	9.10	7.19	184,000
61	Mar 9	18.19	16.28	534,000
62*	Apr 25	10.46	8.55	231,000
63	Mar 26	7.90	5.99	146,000
64	Apr 22	13.77	11.86	347,000
65	Feb 25	10.29	8.38	226,000
66	Feb 28	11.85	9.94	280,000
67	Dec 31	9.73	7.82	206,000
68	Jan 4	10.20	8.29	222,000
69	Apr 27	9.44	7.53	196,000
70	Apr 2	11.33	9.42	262,000
71	Mar 13	13.52	11.61	341,000
72	Jan 21	12.67	10.76	309,000
73	Apr 8	13.81	11.90	352,000
74	Jan 10	10.57	8.66	235,000
75	Mar	12.62	10.71	307,000
76	Apr 8	14.95	13.04	398,000**
*1961	Dec 31	14.40	12.49	376,000

** Measured discharge 413,000 cfs

3 10 00298

APPENDIX XV

BACKGROUND LEVELS OF HEAVY METALS, ADEM's LETTER 12/19/86

2468G G361-740

3 10 00299

APPENDIX -XV

ADEM

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

George C. Wallace
Governor

Leigh Pegues, Director

1751 Federal Drive
Montgomery, AL
36130
205/271-7700

Field Offices:

Unit 806, Building 8
225 Oxmoor Circle
Birmingham, AL
35209
205/942-6168

P.O. Box 953
Decatur, AL
35602
205/353-1713

2204 Perimeter Road
Mobile, AL
[illegible]
479-2336

December 19, 1986

Mr. William M. Cawthra, P.E.
Environmental Technical Manager
Stauffer Chemical Company
Dobbs Ferry, New York 10522

RE: Request of November 18, 1986, for background levels of heavy metals in or around the vicinity of Stauffer Chemical's Cold Creek and Lemoyne plants.

Dear Mr. Cawthra:

We are in receipt of the above referenced request. After review of our records it has been determined that the Department does not have any data on file which could be deemed to be representative of background levels near the above referenced Stauffer plants.

For your information I am including the following metals data as recorded from soil samples taken at two locations in Pike County by the Department in 1984.

TOTAL METALS (µg/g)

Near Pike County Lake

Arsenic	Calcium	Cadmium	Iron	Lead	Zinc
10.2	214.0	5.0	3,410.0	8.0	10.0

Roadside Sample - U.S. Hwy 231 (Mile 79)

Arsenic	Calcium	Cadmium	Iron	Lead	Zinc
29.0	472.0	2.0	6,997.0	220.0	44.0

After review of the above, should you have any questions, please do not hesitate to contact this office.

Sincerely,

E. John Williford

E. John Williford, Chief
Field Operations Division

FJW/RWC/mpt
cc: Joe Downey, ADEM

3 10 00300

APPENDIX XVI

MATRECON INC's REPORT ON MEMBRANE TESTS AND INTERPRETATION

3 10 00301

Appendix - XI

Interoffice Memorandum

TO: W. Cawthra - EEC

FROM: L. E. Drake - EEC

SUBJECT: LeMoyne Cap Liner

DATE: 12/5/86

CC:

FILE: 3955A012
P.F. 7.1-9

key word: LeMoyne

The Matrecon, Inc. test results on the samples taken from the duPont 3110 cap liner at LeMoyne indicate to me that there has been only a small change in the important properties of that material since installation in 1974. Its integrity should still be good and useful life expectancy high. A repeat of the tests in 5 years would be recommended.

L. E. Drake

LED/cm

5 10 00302

matrecon, inc.

RESEARCH · CONSULTING · TESTING · NON-METALLIC MATERIALS

P O Box 24075
Oakland, CA 94623

2811 Adeline Street
Oakland, CA 94608

(415) 451-27

M87-343

RECEIVED
OCT 23 1986
ENVIRONMENTAL CONTROL

October 15, 1986

Mr. Danny Flack
Stauffer Chemical Company
Highway 43
Axis, AL 36505

Dear Mr. Flack:

Re: Report on the Testing of Exposed 3110 Cap Liners - P.O. #025-033112

Enclosed is our report, "Testing of Exposed 3110 Membrane Liner Samples Collected by Stauffer Chemical Company at their Mobile, Alabama Facility."

Also enclosed is the "Chain of Custody Record" signed by Gary Walvatne, which you asked to be returned.

If you have any questions, please contact me.

Sincerely,

Henry E. Haxo, Jr.
President

HEH/rmr

Enclosures: 1 copy of report
1 signed chain of custody record

SCC
CC: R. HALSTEAD - orig.
T. SAYERS - WSPT
B. STILSON
B. JOYCE

STAUFFER CHEMICAL COMPANY
CHAIN OF CUSTODY RECORD
CC/Lemoyne SF RI/FS

3 10 00303

Sample Source: LINERS Collected By: W.P. STILSON Analysis Lab: MATRECON Field Notebook: CERCLA No. 1

Date: 8 / 8 & 11 / 86 Time: VARIOUS Log Notebook: —

Relinquished By: W.P. STILSON Date: 8 / 11 / 86 Time: 3:30 PM Received By: [signature] 8/12/86

NOTE: LINER MATERIAL IS DUPONT 3110 20 MIL PURCHASED AND INSTALLED IN 1974

No.	Sample No.	Test Category	PP VOA	Metals	B/N Acid Pesticides & PCB	CY	Hg	Thiocarbamates	Organo Phos.	Cl	Cl_2	Col.	Fe	$SO_4/SO_3/S$	Thiocyanate	TENSILE	Shipment Container	Storage Condition —LAB	Comments
1	LLF-1P															X	PLASTIC BAG		ASTM D 638 TYPE 4
2	SLF-1P															X	"		" " "
3	NLF-1P															X	"		" " "

3 10 00304

M87-343

TESTING OF EXPOSED 3110 MEMBRANE LINER SAMPLES COLLECTED BY STAUFFER CHEMICAL COMPANY AT THEIR MOBILE, ALABAMA FACILITY

by

Henry E. Haxo, Jr.
Benjamin B. White
Gary Walvatne

Prepared for

Mr. Danny Flack
Stauffer Chemical Company
Highway 43
Axis, AL 36505

Stauffer Chemical Company
P.O. #025-033112

October 15, 1986

Matrecon, Inc.
2811 Adeline Street
Oakland, CA 94608

TESTING OF EXPOSED 3110 MEMBRANE LINER SAMPLES COLLECTED BY STAUFFER CHEMICAL COMPANY AT THEIR MOBILE, ALABAMA FACILITY

INTRODUCTION

Mr. Danny Flack of Stauffer Chemical Company requested, under P.O. #025-033112, that Matrecon, Inc. determine the tensile properties and volatiles content of three samples of exposed 20-mil 3110 elasticized polyolefin, taken from the cap liners of three separate landfill units. These samples were collected by Stauffer Chemical from their Mobile, Alabama facility. The cap liners had been installed in 1974 and were being checked for elasticity under a Remedial Investigation Feasibility Study (RIFS), as required by the U.S. Environmental Protection Agency. The purchase order called for tensile testing in accordance with ASTM D638-84, using a Die IV dumbbell.

No retained sample was available for comparative testing, nor were there any test data pertaining to the specific lots of 3110 that had been used. The tensile test data available from du Pont, the manufacturer of 3110, was based on ASTM D882-3, which they used in developing their specification for 3110. Consequently, Stauffer approved tensile testing of the exposed samples in accordance with ASTM D882-73; it was expected that specific test data on the unexposed sheeting, would become available from du Pont or the installer so that a comparison could be made with the original property values and, thus determine whether the properties had changed during exposure. However, no property values on the unexposed sheeting became available.

This report presents the results of tensile testing of the exposed 3110 sample, in accordance with both ASTM D638-84 and D882-73 tests, and results of the determination of volatiles content.

SUMMARY

The test values for the exposed cap liner sample, identified as LLF-1P, tested in accordance with ASTM D638-84 were equal to those in the Matrecon database for unexposed 3110 sample, also determined in accordance with the same test method. The values for the properties of the other two samples, SLF-1P and NLF-1P, were somewhat lower, indicating possible loss, but the differences are probably within testing error. The values exceeded the test values given in the du Pont specification (1). However, the du Pont values were obtained in accordance with ASTM Test Method D882-73, which requires strip specimens.

The results of the testing of the exposed samples, in accordance with ASTM D882-73, yield similar modulus values (stresses at 100% and 200% elongation), as obtained in the D638-84 tests. However, the tensile strength values were lower and the strip specimens slipped in the grips to yield false elongation values, when jaw separation was used to measure elongation. The samples were retested and the elongation was followed by benchmarks. Elongation at break values were somewhat lower than the values obtained with the dumbbell specimens, as were the tensile strength values. This is usual when results obtained with strips are compared with those obtained with dumbbell specimens, particularly when testing materials having high elongation.

(1) Du Pont Specification E-90896.

Comparison of the D882-73 data with the du Pont specification values, indicate that there may have been some loss in values of tensile strength and elongation at break, and there was stiffening of the sheeting. However, comparison of test values obtained with the dumbbell specimens with those in the Matrecon database, also obtained with dumbbell specimens, indicate that little or no change in properties took place during the exposure since 1974.

We believe the latter data more accurately reflect the property values of the exposed 3110 membrane cap liner.

MATERIAL

On August 12, 1986, Matrecon received three field-exposed samples of 20-mil du Pont 3110 elasticized polyolefin liner. These liner samples identified as LLF-1P, SLF-1P, and NLF-1P by Stauffer, had been removed from the cap of each of three landfills by Stauffer Chemical Company at their Mobile, Alabama facility. These samples were given Matrecon identification numbers E475, E476, and E477, respectively. An inventory and dimensions of the samples are presented in Table 1. Sample LLF-1P (E475) was received with two small cuts (1/4-in. to 1/2-in. long), one 2-in.-long cut, and a hole at the apex of a dimple in the sheeting.

TEST METHODS

Tensile properties of the exposed 3110 samples were measured at the request of the client, in accordance with both ASTM D638-84 and D882-73 test methods.

Tensile testing was conducted in accordance with ASTM D882-73 using 1 in. by 6-in. strip specimens. Initial jaw separation was 2 inches and the rate of jaw separation was 20 inches per minute (ipm).

TABLE 1. INVENTORY OF EXPOSED DU PONT 3110 20-MIL LINER SAMPLES COLLECTED BY STAUFFER CHEMICAL COMPANY AT THEIR MOBILE, ALABAMA FACILITY

Matrecon identification	Client identification	Sample size, in.	Date received
E475	Sample No. LLF-1P, Le Moyne Landfill Cover 8/8/86 @ 10:55 AM, W.P.S.	19 x 19	8-12-86
E476	Sample No. SLF-1P, Cold Creek South Landfill Cover, 8/8/86 @ 2:30 PM, W.P.S.	19 x 19	8-12-86
E477	Sample No. NLF-1P, Cold Creek North Landfill Cover, 8/11/86 @ 8:45 AM, W.P.S.	19 x 19	8-12-86

Tensile testing was also conducted in accordance with ASTM D638-84 using type IV dumbbell specimens and a rate of jaw separation of 20 ipm.

The volatiles content was measured by weighing a specimen before and after heating it in an oven at 105°C for 2 hours.

RESULTS

Values for tensile strength and volatiles content are summarized in Table 2. Values for tensile strength, measured in accordance with ASTM D638-84, are compared with values obtained from Matrecon's data base for unexposed du Pont 3110 22-mil sheeting which was tested under the same conditions.

Tensile property values, measured in accordance with ASTM D882-73 with strip specimens, are compared with the du Pont specification values taken from the du Pont Brochure E906896. The specification values are generally conservative and may not be typical of the actual test data. During these tests, the strip specimens slipped in the tester grips. This resulted in false elongation-at-break values, that were substantially in error on the high side, as the elongations were measured by jaw separation. Also, the tensile strength values were significantly lower than the values in the specification.

The tests of tensile properties, in accordance with ASTM D882-73 using strip specimens with benchmarks, were repeated. The results presented in Table 3 show comparable moduli (S-100% and S-200%) to those obtained with dumbbell specimens. The ends of the specimens still slipped in the grips and 10 of the 12 specimens broke outside the benchmarks, resulting in low tensile values.

Henry E. Haxo, Jr. Henry E. Haxo, Jr.
President

Benjamin B. White Benjamin B. White
Physical Testing Laboratory

Gary Walvatne Gary Walvatne
Liner Materials Laboratory

HEH/BBW/GW:rmr

Attachments: 3 Tables

3 10 00310

TABLE 1. INVENTORY OF EXPOSED DU PONT 3110 20-MIL LINER SAMPLES COLLECTED BY STAUFFER CHEMICAL COMPANY AT THEIR MOBILE, ALABAMA FACILITY

Matrecon identification	Client identification	Sample size, in.	Date received
E475	Sample No. LLF-1P, Le Moyne Landfill Cover 8/8/86 @ 10:55 AM, W.P.S.	19 x 19	8-12-86
E476	Sample No. SLF-1P, Cold Creek South Landfill Cover, 8/8/86 @ 2:30 PM, W.P.S.	19 x 19	8-12-86
E477	Sample No. NLF-1P, Cold Creek North Landfill Cover, 8/11/86 @ 8:45 AM, W.P.S.	19 x 19	8-12-86

Matrecon, Inc.
M87-343 <1232>
September 23, 1986

TABLE 2. TENSILE PROPERTIES AND VOLA ONTENT OF EXPOSED DU PONT 3110 20-MIL LINER SAMPLES[a] COLLECTED BY STAUFFER CHE OMPANY AT THEIR MOBILE, ALABAMA FACILITY

Property	Test direction	Stauffer sample identification: LLF-1P (E475)[a]	Stauffer sample identification: SLF-1P (E476)[a]	Stauffer sample identification: NLF-1P (E477)[a]	Du Pont specification value[b]	Du Pont 3110 22-mil liner (36) from Matrecon database
Volatiles, %		0.49	0.32	0.43	...	0.15
Tensile properties measured in accordance with ASTM D882-73[c]						
Tensile at break, psi	Machine	2555	2360	2325	2400	...
	Transverse	2230	1990	2360	2400	...
Elongation at break, %	Machine	d	d	d	600	...
	Transverse	d	d	d	600	...
Stress at 100% elongation, psi	Machine	1015	995	975	750	...
	Transverse	885	930	970	750	...
Stress at 200% elongation, psi	Machine	1075	1075	1030	800	...
	Transverse	980	1015	1020	800	...
Tensile properties measured in accordance with ASTM D638-84[e]						
Tensile at break, psi	Machine	2810	2570	2445	...	2715
	Transverse	2495	2215	2610	...	2525
Elongation at break, %	Machine	715	615	600	...	675
	Transverse	635	550	615	...	655
Stress at 100% elongation, psi	Machine	955	995	985	...	940
	Transverse	940	925	960	...	905
Stress at 200% elongation, psi	Machine	1035	1085	1055	...	1035
	Transverse	1005	1020	1045	...	1000

[a]Matrecon identification numbers.

[b]From du Pont Brochure E90896.

[c]Tested specimen: strip 1 in. x 6 in.

[d]Slipped in grips.

[e]Test specimen: Type IV dumbbell.

3 10 00311

3 10 00312

D882-73

TABLE 3. RETENTION OF TENSILE PROPERTIES OF EXPOSED SAMPLES IN ACCORDANCE WITH ASTM D88-73 USING STRIP SPECIMENS WITH BENCHMARKS[a]

Property	Test direction	Stauffer sample identification LLF-IP (E475)[b]	SLF-IP (E476)[b]	NLF-IP (E477)[b]	Du Pont specification value[c]
Tensile at break, psi	Machine	2305	2085	2115	2400
	Transverse	2075	1815	2205	2400
Elongation at break, %	Machine	635	575	600	600
	Transverse	610	505	635	600
Stress at 100% elongation, psi	Machine	970	935	980	750
	Transverse	905	880	950	750
Stress at 200% elongation, psi	Machine	1020	1015	1020	800
	Transverse	965	975	990	800

[a]Each sample was tested in duplicate in each direction; values are averages. Out of the 12 specimens tested in the retest, 10 of the specimens broke outside the benchmarks, i.e. between the benchmarks and the grips.

[b]Matrecon identification numbers.

[c]From du Pont Brochure E90896.

Matrecon, Inc.
M87-343 <1232>
October 14, 1986

3 10 00313

3110

SPECIFICATION
DU PONT 3110* ELASTICIZED POLYOLEFIN SHEETING

Property	Test Method	Requirement
Tensile Strength	ASTM D-882-73	Min. 2400 psi.
Modulus @ 100%	ASTM D-882-73	Min. 750 psi.
200%		Min. 800 psi.
Elongation at Break	ASTM D-882-73	Min. 600%
Water Absorption	ASTM D-471 (14 days @ 212°F.)	Max. Wt. Change 3.0%
Cold Bend Test Brittleness Temperature	ASTM D-2136 ASTM D-746 Procedure "B"	No Cracks at −60°C. (−76°F.)**
Ozone Resistance	ASTM D-1149 3 ppm @ 30% Strain @ 104°F. for 70 hrs. Procedure "A"	No Cracks 6x Magnification
After Heat Aging	ASTM D-412	
Tensile Strength	(14 days @ 212°F.)	Min. 2300 psi.
Elongation at Break		Min. 500%
Specific Gravity	ASTM D-792 (25/4°C.)	0.90 ±0.05
Graves Tear	ASTM D-1004	Min. 300 lb./in.
Dimensional Stability (linear)	ASTM D-1204 After 3 hours @ 212°F.	Max. 4%
Volatiles or Plasticizer Loss	ASTM D-1203 Method "A" Thickness 0.021"	Max. Wt. Loss 0.5%

**The brittleness temperature is lower than −60°C. (−76°F.), but this was the limit of the test equipment.

*Du Pont Trademark for elasticized polyolefin sheeting and welder.

E. I. DU PONT DE NEMOURS & CO. (INC.)
ELASTOMER CHEMICALS DEPT.
SUITE 724, BANK OF DELAWARE BUILDING
WILMINGTON, DELAWARE 19898

Phone for:
Order Service: (302) 774-5929
Technical Assistance:
(302) 774-8445
(302) 774-4758

APPENDIX XVII

MERCURY IN SWAMP MAP, DWG. 1.3

OVERSIZED

DOCUMENT

MAP

APPENDIX XVIII

TRACE CHEMICAL ELEMENT CONTENT OF NATURAL SOILS

3 10 00317

Appendix XVIII

TRACE CHEMICAL ELEMENT CONTENT OF NATURAL SOILS

Element	Common Range (ppm)	Average (ppm)
Aluminum	10,000-300,000	71,000
Antimony	2-10	-
Arsenic	1-50	5
Barium	100-3,000	430
Beryllium	0.1-40	6
Boron	2-100	10
Bromine	1-10	5
Cadmium	0.01-0.7	.06
Cesium	0.3-25	6
Chlorine	20-900	100
Chromium	1-1,000	100
Cobalt	1-40	8
Copper	2-100	30
Fluorine	10-4,000	200
Gallium	0.4-300	30
Gold		1
Iodine	0.1-40	5
Lanthanum	1-5,000	30
Lead	2-200	10

3 10 00318

Appendix XVIII

TRACE CHEMICAL ELEMENT CONTENT OF NATURAL SOILS - CONTD.

Element	Common Range (ppm)	Average (ppm)
Lithium	5-200	20
Magnesium	600-6,000	5,000
Manganese	20-3,000	600
Mercury	0.01-0.3	.03
Molybdenum	0.2-5	2
Nickel	5-500	40
Radium	8×10^{-5}	
Rubidium	50-500	10
Selenium	0.1-2	.3
Silver	0.01-5	.05
Strontium	50-1,000	200
Tin	2-200	10
Tungsten		1
Uranium	0.9-9	1
Vanadium	20-500	100
Yttrium	25-250	50
Zinc	10-300	50
Zirconium	60-2,000	300

REF: USEPA Office of Solid Waste and Emergency Response, HAZARDOUS WASTE LAND TREATMENT, SW-874 (April, 1983) Page 273, Table 6.46.

3 10 00319

APPENDIX XIX
COMPREHENSIVE TOXICITY REVIEW

Mercury

Mercury exists as the metallic, inorganic and organic forms, which can be changed in the environment. For example, inorganic mercury can be converted to methyl and dimethyl mercury by microorganisms both aerobically and anaerobically. Most of the mercury in drinking water is in the inorganic form.

The ACGIH has established the following TLVs for mercury compounds

mercury vapor	0.05 mg/m^3 TWA
aryl and inorganic mercury	0.10 mg/m^3 TWA
alkyl mercury	0.01 mg/m^3 TWA
	0.03 mg/m^3 STEL

The WHO guideline (1984) for total mercury in drinking water is 1 ug/l. The EPA MCL for mercury is 2 ug/l.

Mercury can be taken up by fish, bioaccumulate, and produce toxic effects in humans ingesting contaminated fish. Mercury concentrations of 0.20 ppm or less are normal for freshwater fish. The FDA has established a mercury concentration of 0.5 ppm in the edible portion of fish tissue as a criteria for recommending legal action to the Division of Regulatory Guidance.

Carbon Tetrachloride

The ACGIH has established 5 ppm TWA as the TLV for carbon tetrachloride. The STEL of 20 ppm has been deleted until more information is available.

The risk estimates for carbon tetrachloride have been reported by the Safe Drinking Water Committee (1977) based on the chronic animal studies and using a dose per surface area conversion factor. The estimates of lifetime risk for man ingesting 1 ug/l are 4.5 - 5.4 x 10^{-8}. The 95% upper confidence limits are 1.0 - 1.1 x 10^{-7}.

Carbon tetrachloride is considered to be slightly toxic to aquatic species. The EC50 in daphnia at 48 hr is 35.2 mg/l. The LC50 in bluegill at 96 hr. has been reported to be 125 mg/l, 27 mg/l and 38 mg/l. The LC50 in tidewater silverside at 96 hr. is 150 mg/l. The LC50 in limanda at 96 hr. is 50 mg/l. The LC50 in limanda at 16 hr. is 50 mg/l. Carbon tetrachloride has a low potential to bioaccumulate in fish (RTECS, HSDB, 1986).

Rainbow trout were given diets containing 3200 and 12800 ppm of carbon tetrachloride for 20 months. Hepatomas were found in 4/44 animals at the low dose, 3/34 animals at the high dose and none in the controls (RTECS, HSDB, 1986).

Nickel

The average daily oral intake of nickel has been reported to be 400 to 500 ug/day (FR Vol. 50, No. 219, 46977). Most of the nickel that is ingested is not absorbed and is excreted in the feces. Fecal excretion of nickel is 100 times greater than urinary excretion. There appears to be a mechanism that limits the intestinal absorption of nickel in mammals, despite the relatively large amounts of nickel in their food (Drinking Water and Health, 1977).

3 10 00321

The ACGIH has established the following TLVs for nickel compounds:

metal	1.0 mg/m^3
insoluble compounds	1.0 mg/m^3
soluble inorganic compounds	0.1 mg/m^3

The average concentration of nickel in tap water is approximately 4.8 ug/l (FR Vol 50, No. 219, 46977). Because of the low toxicity of nickel in food and drinking water, the low concentrations present in drinking water, and the small daily intake of nickel in drinking water (compared with food), there has been no need to establish safe levels for nickel in drinking water. The USEPA National Interim Primary Drinking Water Standards and the WHO European standards for drinking water do not include standards for nickel. However, a guidance level of 0.15 mg/l has been determined based on a two year feeding study in the rat (NOAEL of 5 mg/kg/day) and the estimated intake of nickel from food and air (FR Vol. 50, No. 219, 46978).

The LC50 for Channa punctatis at 96 hr. is 307 mg/l for nickel. The LC50 for Daphnia magna at 3 wk. is 0.13 mg/l. The LC50 for Acroneuria lycoria at 96 hr. is 4 mg/l. The LC50 for Artemia salina at 48 hr. is 163 mg/l. (RTECS, HSDB, 1986).

Nickel affected the hatching process, delayed hatching and increased mortality of embryos when eggs, alevins, swim-up fry and 8 month old Atlantic salmon were exposed to nickel. The maximum acceptable toxicant concentration was approximately 50 ng/l (RTECS, DSDB, 1986).

Although aquatic organisms may accumulate nickel from their surroundings, there is little evidence for significant biomagnification of nickel along food chains (RTECS, HSDB, 1986).

The EPA has recently issued the following ambient water quality criteria for nickel: The four day average fresh water concentration is $e^{(0.8460[\ln(\text{hardness})]-1.1645)}$ ug/l. The one hour average fresh water concentration is $e^{(0.8460[\ln(\text{hardness})]+3.3612)}$.

Chromium

The ACGIH has established the following TLVs for chromium compounds:

metal	0.5 mg/m^3
Cr^{+2}	0.5 mg/m^3
Cr^{+3}	0.5 mg/m^3
Cr^{+6} (water soluble compounds)	0.05 mg/m^3
Cr^{+6} (certain water insoluble compounds)	0.05 mg/m^3
Cr (chromate ore processing)	0.05 mg/m^3

The interim drinking water standard for chromium is 0.05 mg/l. The ambient water quality criterion to protect human health from Cr^{+6} is also 0.05 mg/l (RTECS, HSDB, 1986).
The ambient water quality criterion for total recoverable, Cr^{+6} to protect freshwater aquatic life is 0.9 ug/l as a 24 hr. average, and a ceiling of 21 ug/l. The concentration of total chromium should not exceed 0.05 mg/l for the protection of freshwater organisms (RTECS, HSDB, 1986).

3 10 00322

Cyanide

Cyanide is relatively uncommon in most U.S. water supplies. The average cyanide concentration was 0.09 ug/l and the highest cyanide concentration was 8 ug/l in 2595 water samples of 969 U.S. public water supply systems in 197? (FR Vol. 50, No. 219, 46978).

The ACGIH has established the following TLVs for cyanide compounds

sodium cyanide	5 mg/m^3
potassium cyanide	5 mg/m^3

The WHO considers a guideline value of 0.1 mg/l to be reasonable for cyanide. The EPA's ambient water quality criteria for cyanide is 3.77 mg/l. Since cyanide levels in drinking water are so low, the EPA has decided not to propose an RMCL for cyanide (FR Vol. 50, No. 219, 46978).

Zinc

Zinc is an essential trace element in human and animal nutrition. The recommended daily allowances for zinc recommended by the NAS are as follows: adults, 15 mg/day; growing children over one year old, 10 mg/day; and additional supplements during pregnancy and lactation. As far as human health in the general population is concerned, the major concern with zinc is not with toxicity, but rather with marginal or deficient intake.

Levels of zinc in drinking water are typically less than 0.2 mg/l, the maximum is 1.5 mg/l (Drinking Water and Health, 1980). Food is the major source of zinc, approximately 12 mg/day. The contribution of drinking water to the daily nutritional requirement for zinc is negligible under most circumstances.

The ACGIH has established the following TLVs for zinc compounds:

zinc chloride	1 mg/m^3 TWA
	2 mg/m^3 STEL
zinc chromates	0.05 mg/m^3
zinc oxide	5 mg/m^3 TWA fume
	10 mg/m^3 TWA total dust
	10 mg/m^3 STEL fume
zinc stearate	10 mg/m^3 TWA total dust

The NAS Safe Drinking Water Committee stated that "zinc is an essential nutrient for humans. There is evidence of borderline deficiencies of the element in children in the United States as well as in other parts of the world.... The possibility of detrimental health effects arising from zinc consumed in food and drinking water is extremely remote" (FR Vol. 50, No. 219, 46981).
The secondary drinking water standard and recommended primary interim drinking water standard for zinc are 5 mg/l (Drinking Water and Health, 1977).

3 10 00323

Pesticides

Drinking water concentration guidelines have been developed by Stauffer Chemical Company for EPTC, butylate, vernolate, pebulate, molinate and cycloate. The guidelines are derived from the acceptable daily intakes established by the EPA or from the no observable effect levels from various Stauffer toxicology studies. In the calculation of these guidelines, it was assumed that the body weight was 10 kg and that 1 l of water was ingested per day. The proposed safe drinking water levels are listed below:

Compound	Proposed Safe Drinking Water Level (mg/l)
EPTC	0.5
Butylate	2.0
Vernolate	0.1
Pebulate	4.0
Molinate	0.2
Cycloate	0.05

The proposed safe drinking water levels for EPTC and butylate are based on the acceptable daily intake established by the EPA as listed in the Registration Standards. The proposed safe drinking water level for vernolate is based on the no observable effect level for the 2-generation reproduction study in the rat (1 mg/kg/day) and a safety factor of 100. The proposed safe drinking water level for pebulate is based on the no observable effect level in the chronic feeding study in the mouse (40 mg/kg/day) and a safety factor of 100. The proposed safe drinking water level for molinate is based on the no observable effect level in the 3-generation reproduction study in the rat (0.2 mg/kg/day) and a safety factor of 10. The proposed safe drinking water level for cycloate is based on the no observable effect level in the chronic feeding study in the rat (0.5 mg/kg/day) and a safety factor of 100.

Molinate

Subchronic Feeding in the Rat

Molinate was fed to rats at dietary levels to provide 0, 35, 70 and 140 mg/kg/day. Signs of toxicity include increased thyroid and adrenal weights, kidney damage, changes in the ovaries and slight changes in the adrenals. A no effect level was not defined in this study.

In a second study, molinate was fed to rats at dietary levels to provide 0, 8, 16 and 32 mg/kg/day. Signs of toxicity include increased thyroid weights and slight changes in the adrenals. The no deleterious effect level was 8 mg/kg/day.

Subchronic Feeding Study in the Dog

Slightly increased thyroid weight was observed in dogs fed molinate at 41 mg/kg/day. No effects were observed at 20 mg/kg/day.

Subchronic Inhalation Study in the Rat

Two subchronic inhalation studies in the rat were performed at Stauffer Chemical. In the first study, animals were exposed to molinate at concentrations of 0, 0.1, 0.6, 1.8, or 4.0 mg/m^3 for 6 hr/day, 5 days/wk for 13 weeks. Signs of toxicity included nasal epithelial and sinus alterations, necrotizing rhinitis, slight degeneration of the testicular germinal epithelium and decreased fertility.

In the second study, male animals were exposed to molinate at concentrations of 0, 0.07, 0.16, 0.30, 0.64 or 1.6 mg/m^3 for 6 hr/day, 5 days/wk for 4 weeks. Decreased fertility was observed for animals at the 0.64 and 1.6 mg/m^3 levels. No effects on fertility were observed at the 0.07, 0.16 or 0.30 mg/m^3 levels.

Fertility Study in the Male Mouse

Animals were treated at dosages of 0, 2, 20, 100 or 200 mg/kg/day by gavage for seven weeks. Decreased fertility was observed in males at the 100 and 200 mg/kg/day levels. The decreased fertility was reversible after a 4 week recovery period. No effects on fertility were observed at the 2 or 20 mg/kg/day levels and no histopathological changes were observed at any of the dosage levels.

Fertility Study in the Male Rat

In the preliminary phase of this study, animals were treated at dosages of 0, 12, or 60 mg/kg/day for 5 days. Subsequently the animals were mated with 1 female/wk for 10 weeks. The results of this study indicate late spermatid development is affected by molinate. No effects were observed at 12 mg/kg/day.

In the final phase of this study, animals were treated at dosages of 0, 0.2, 4, 12 or 30 mg/kg/day for 5-10 wk. Subsequently the animals were mated with 2 females/wk for 1-2 wk. Decreased fertility, changes in sperm viability morphology, motility and concentration, and an increase in degenerating spermatids were observed at the 4, 12 and 30 mg/kg/day levels. No effects were observed at the 0.2 mg/kg/day level for 5 weeks.

Fertility Study in the Male Rabbit

Animals were treated at dosages of 0, 2, 20 or 200 mg/kg/day in capsules for 6 weeks. No effects on fertility or histopathology were observed at any of the dosage levels.

3 10 00325

Sperm Production Study in the Male Monkey

Animals were treated orally at dosages of 0, 0.2, 10 or 50 mg/kg/day five days/wk for 12 weeks. No effects were observed in sperm motility, sperm morphology, sperm concentration, seminal fluid volume, serum luteinizing hormone, serum follicle stimulating hormone or serum testosterone levels at any of the dosage levels.

Reproduction Study in the Rat

A three generation reproduction study in the rat was performed with molinate at dosage levels of 0, 0.063, 0.2 and 0.63 mg/kg/day in the diet. A reduction in the number of litters produced per number mated and a decrease in pup survival were observed at the highest dosage level. No effects were observed at the low or mid dosage levels.

Rats appear to be the most sensitive to the fertility effect of molinate. Further studies in rats of timed matings and electron microscopy of sperm demonstrated that the fertility effects correspond to the time the sperm are extruded from the Sertoli cells. Electron micrograph studies showed that the membrane of the midpiece of sperm appeared to rupture or disappear as an early event, even when mitochondria appear normal. Subsequently, head and midpiece separate and total disorganization of the midpiece occurs. This suggest the site of action may be directly on the sperm and that it occurs either just before or just after extrusion from the Sertoli cells. Gross morphology of rat sperm differs considerably from rabbit and monkey sperm, especially with respect to the relative length of the midpiece and the manner of its attachment to the head. In this aspect, human sperm more closely resemble rabbit and monkey sperm. The male monkeys reproductive system is most similar to humans with respect to physiology, hormonal system and sperm morphology.

Teratology Study in the Mouse

Molinate was fed to mated female mice at dietary levels providing dosages of 0, 8 and 24 mg/kg/day on gestation days 6-15. No signs of maternal toxicity were observed and no teratogenic effects were observed in the fetuses.

Teratology Study in the Rabbit

Molinate was administered by oral gavage to mated female New Zealand White rabbits on gestation days 7 through 19 at dosages of 0, 2, 20 and 200 mg/kg/day. Embryofetotoxicity was observed at the 200 mg/kg/day level, but was considered to be secondary to maternal toxicity. The no effect level for maternal and embryofetotoxicity was 20 mg/kg/day. No teratogenic effects were observed at any dosage level.

Chronic Study in the Mouse

Molinate was fed to CAF hybrid mice at dietary levels providing dosages of 0, 3.6, 7.2 and 14.4 mg/kg/day for 99-101 weeks. Additional groups were exposed in utero and during gestation followed by similar dietary feeding for a total exposure up to 76 weeks. Survival at the high dosage level in mice exposed in utero may have been slightly reduced. The no effect level was 7.2 mg/kg/day.

Chronic Study in the Rat

Molinate was fed to Fisher rats at dietary levels providing dosages of 0, 8, 16 and 32-mg/kg/day for the first 18 weeks, and 0, 0.63, 2.0 and 6.32 mg/kg/day for the remainder of the experiment (at least 104 wk). Signs of toxicity included decreased body weight gain, increased testicular weight and possibly decreased kidney weight. No effects were observed at 0.63 mg/kg day.

Genetic Toxicity Studies

Molinate was negative in a Rec-assay with Bacillus subtilis H-17 and M-45 strains. Molinate was negative in tests with Eschericha coli WP2 hcr strain and five strains of Salmonella typhimurium both with and without a metabolic activation system. Molinate was negative in a host mediated assay in mice using Salmonella typhimurium G-46. Molinate was negative in a micronucleus test in the mouse. Molinate was negative in an in vitro chromosomal aberration and sister chromatid exchange test with mouse lymphoma cells.

Neurotoxicity Study in the Hen

Molinate was administered to hens orally at 0, 0.02, 0.063, 0.20, 0.63 and 2.0 g/kg two times with a 3 week interval. Mortality was associated at the 0.63 and 2.0 g/kg levels. Degeneration of nerve axons in brain, spinal cord and peripheral nerves was found in all hens at the 0.63 and 2.0 g/kg dosage levels. However, none of the molinate-treated hens exhibited clinical signs of delayed neurotoxicity similar to those seen after administration of the positive control.

Toxicity Study in Mallard Ducks

Molinate was fed to mallard ducks at dietary concentrations of 0.1, 0.18, 0.32, 0.56, 1.0, 1.8 and 3.2% for five days. The LC50 was 1.3% and the no effect level was 0.1%.

Subchronic Toxicity Study in Coturnix Quail

Molinate was fed to quail at dietary concentrations of 10, 100 and 1000 ppm for nine weeks. Signs of toxicity included decreases in feed intake, body weight and hatchability. No effects were observed at the 10 ppm level.

Toxicity Studies to Aquatic Species

The LC50 of molinate in rainbow trout is 0.54 mg/l at 24 hr, 0.29 mg/l at 48 hr and 0.20 mg/l at 96 hr. The LC50 of molinate in Leiostomus xanthurus, an estuarine fish, is greater than 1 mg/l at 24 and 48 hr. The EC50 of molinate in in oysters is greater than 1 mg/l at 96 hr. The EC50 for molinate in Penaeus azterus is greater than 1 mg/l at 24 and 48 hr.

3 10 00327

The toxicity of these materials to aquatic species is listed below:

Compound	Specie	Time Point (hr.)	Endpoint	Value
EPTC	bluegill sunfish	96	LC50	14 mg/l
	trout	96	LC50	10-35 mg/l
	daphnia	48	LC50	14 mg/l
Butylate	bluegill sunfish	96	LC50	6.4 mg/l
	trout	96	LC50	7.0 mg/l
	daphnia	48	LC50	11.9 mg/l
Vernolate	bluegill sunfish	96	LC50	8.4 mg/l
	trout	96	LC50	9.6 mg/l
	daphnia	48	LC50	7.6 mg/l
Pebulate	bluegill sunfish	96	LC50	7.4 mg/l
	trout	96	LC50	7.4 mg/l
	daphnia	48	LC50	2.1 mg/l
Molinate	bluegill sunfish	96	TL50	18.8 mg/l
	trout	96	TL50	6.97 mg/l
	daphnia	48	LC50	19.4 mg/l
Cycloate	bluegill sunfish	96	LC50	4.6-6.8 mg/l
	daphnia	48	LC50	24 mg/l

In addition, a 25 day bioconcentration study has been conducted with radiolabelled cycloate in bluegill sunfish. By day 14 of the depuration phase, 94-98% of the cycloate was eliminated. This indicates that bioconcentration of cycloate is not remarkable and that residues are rapidly cleared from fish tissues once exposure is terminated.

EPTC

Subchronic Rat Feeding Study

EPTC was fed in the diet to groups of rats to provide dosage levels of 0, 8, 16 and 32 mg/kg/day for 13 wks. Signs of toxicity at the 32 mg/kg/day level include decreased body weight and food intake and slight irregularity in hepatic cell size with some glycogen depletion. No adverse effects were observed at the 8 and 16 mg/kg/day levels.

Subchronic Dog Feeding Study

EPTC was fed in the diet to groups of dogs at dosage levels of 0, 450, 900 and 1800 ppm. Signs of toxicity included decreased brain cholinesterase levels, hair loss and changes in gastric mucosa.

Subchronic Rat Inhalation Study

Animals were exposed to 0, 8.3, 58 or 290 mg/m^3 for 6 hours/day, 5 days/week for three months. Signs of toxicity included decreased food consumption (mid and high dosage levels), increased SGOT (high dosage level), mild transient histopathological changes in nasal epithelium and sinuses (mid and high dosage levels), decreased brain cholinesterase levels (high dosage level) and myocardial degeneration (high dosage level). The latter observation was considered by the EPA to be virally induced. No treatment-related effects were observed at the low dosage level.

Rat Teratology Study

EPTC was administered to groups of mated female Charles River CD® rats by gavage at dosage levels of 0, 30, 100 and 300 mg/kg/day on gestation days 6 through 15. Maternal toxicity was observed at the highest dosage level. Slight embryotoxicity may have been observed at the mid-dosage level. No effects were observed at the low-dosage level. No teratogenic effects were observed at any dosage level.

Reproduction Study in the Rat

EPTC was fed to groups of rats at dietary levels of 0, 40, 200 and 1000 ppm for two generations with two matings per generation. No adverse reproductive effects were observed.

Chronic Mouse Feeding Study

EPTC was fed in the diet to groups of mice to provide dosage levels of 0, 5, 20 and 80 mg/kg/day for two years. Signs of toxicity included decreased body weight and food consumption.

3 10 00329

Chronic Rat Feeding Study

The rats received EPTC in the feed to provide dosage levels of 0, 5, 25 or 125 mg/kg/day for two years. Signs of toxicity included mortality (males at the high dosage level) decreased food consumption and weight gain (both sexes at the mid and high dosage levels), coagulopathy (males at the high dosage level), cataracts (females at the high dosage level), altered carriage of the testes (at the high dosage level), and hindlimb weakness and muscular atrophy, hindlimb peripheral nerve and spinal cord axonal degeneration (both sexes at the mid and high dosage levels). A spontaneous level of mild heart muscle degeneration was observed at the control and low dosage levels. EPTC increased the severity of heart muscle degeneration at the mid and high dosage levels. No tumors were considered to be induced by EPTC administration and no treatment related effects were observed at the low dosage level.

Butylate

Subchronic Feeding Study in the Rat

Butylate was fed to groups of rats at dosage levels of 0, 8, 16 and 32 mg/kg/day for 13 weeks. No effects were observed at any dosage level.

Teratology Study in the Mouse

Butylate was administered to groups of mated female mice at dosages of 0, 4, 8 and 24 mg/kg/day on day 6 through termination of gestation. No signs of maternal toxicity and no teratogenic effects were observed in this study.

Teratology Study in the Rat

Butylate was administered to groups of mated female rats by gavage at dosages of 0, 40, 400 and 1000 mg/kg/day during gestation days 6 - 20. The no effect level for general toxicity was 40 mg/kg/day. No teratogenic effects were observed in this study.

Reproduction Study in the Rat

Butylate was fed to groups of rats at concentrations of 0, 200, 1000 and 4000 ppm for two generations. The no effect level for general toxic and reproductive effects was 200 ppm.

Chronic Feeding Study in the Rat

Butylate was fed to groups of rats at dosage levels of 0, 50, 100, 200 and 400 mg/kg/day for 2 years. Signs of toxicity included decreased weight gain, increased food consumption, increase liver weights and increased hepatocellular hypertrophy. No effects were observed at 50 mg/kg/day.

Pebulate

Subchronic Inhalation Study in the Rat

Groups of rats were exposed to mean pebulate concentrations of 0, 3.4, 16.1 and 79.3 mg/m^3 for 6 hr/day, 5 days/wk for 14 weeks. Signs of toxicity include increased in vitro coagulation times, inhibition of brain and erythrocyte cholinesterase levels, kidney damage and changes in nasal epithelium. No effects were observed at 3.4 mg/m^3.

Subchronic Feeding Study in the Rat

Pebulate was administered to groups of rats at dosages of 0, 8, 16 and 32 mg/kg/day for 14-15 weeks. The only sign of toxicity was irritability at the 32 mg/kg/day level. No effects were observed at the 16 mg/kg/day level.

Teratology Study in the Mouse

Pebulate was administered to groups of mated female mice at dosages of 0, 8 and 24 mg/kg/day during gestation days 6 through termination. No signs of maternal toxicity and no teratogenic effects were observed in this study.

Neurotoxicity Study in the Hen

Pebulate was administered to groups of hens at two dosages of 8.9 g/kg with a three week interval between each dosage. No signs of acute delayed neurotoxocity were observed.

Chronic Feeding Study in the Mouse

Pebulate was administered to groups of CD®-1 mice at dosage levels of 0, 10, 40 and 160 mg/kg/day for two years. Signs of toxicity include decreased erythrocyte count, decreased hemoglobin, decreased hematocrit and increased liver weights.

Vernolate

Subchronic Feeding Study in the Rat

Vernolate was administered to groups of rats at dosages of 0, 8, 16 and 32 mg/kg/day for 14 weeks. No signs of toxicity were attributed with certainty to vernolate.

Subchronic Feeding Study in the Dog

Vernolate was administered to groups of dogs at dietary levels of 0, 400, 900 and 1800 ppm. No signs of toxicity were attributed with certainty to vernolate.

Teratology Study in the Mouse

Vernolate was administered to groups of mated female mice at dosages of 0, 8 and 24 mg/kg on gestation days 6 through termination of gestation. No signs of maternal toxicity or teratogenicity were observed at any dosage level.

Teratology Study in the Rabbit

Vernolate was administered to groups of mated female rabbits at dosages of 0, 2, 20 and 200 mg/kg/day for gestation days 6 through 21. No signs of maternal toxicity or teratogenicity were observed at any dosage level.

Reproduction Study in the Rat

Vernolate was administered to groups of rats at dietary levels of 0, 20, 100 and 500 ppm for two generations with two matings per generation. Signs of toxicity included decreased body weight and food consumption. No adverse reproductive effects were observed at any level.

Neurotoxicity Study in the Hen

Vernolate was administered to hens in two dosages of 10 ml/kg with a 21 day interval between dosages. No evidence of delayed paralysis was observed.

Cycloate

Subchronic Inhalation Study in the Rat

Animals were exposed to 0, 1.2, 13 and 119 mg/m^3 for 6 hours/day, 5 days/week for 68 exposure days (three months). An increase in the incidence and/or severity in Wallerian degeneration of the peripheral nerves was observed at the high exposure level. No histopathological effects were observed in peripheral nerves from animals exposed to low or mid dosages.

Teratology Study in the Rat

Cycloate was administered to groups of mated female rats at dosages of 0, 10, 75, 175 and 400 mg/kg/day for gestation days 6 through 15. Signs of maternal toxicity were observed at dosage levels of 175 and 400 mg/kg/day. No signs of embryofetotoxicity or teratogenic effects were observed.

Neurotoxicity Study in the Hen

A neurotoxicity study in the hen was performed at the very high dosage levels of 10,170 mg/kg (2 doses) and 3,051 mg/kg (10 dosages). The LD50 of RO-NEET in the hen is greater than 10,170 mg/kg. No behavioral or histopathological evidence of muscle or nerve degeneration was observed indicating cycloate does not produce acute delayed neurotoxicity.

Chronic Feeding Study in the Mouse

A two year chronic mouse feeding study was performed at dosages of 0, 20, 60 and 180 mg/kg/day. Histopathological examination included brain, spinal cord, nerve and muscle tissues. No effects on nerve or muscle tissue were detected.

Chronic Feeding Studies in the Rat

The first chronic rat study was performed at Hazleton Laboratories with cycloate administered in the feed to provide dosage levels of 0, 8, 24 and 72 mg/kg/day. The second chronic rat study was conducted at Stauffer Chemical Company's Environmental Health Center (EHC) at dosages of 0, 0.1, 0.5, 3 and 16 mg/kg/day. Neuronal and muscular effects occurred principally in older animals and were identical to age-related changes seen in controls. The changes were distinguishable in treated and control animals only by differences in frequency and severity. An increase in the incidence of posterior neuromuscular weakness was also observed in the first study; however, no evidence of neuromuscular impairment or neurotoxicity was observed clinically in the second study. A no observable effect level (NOEL) was not defined in the first study. The Environmental Protection Agency (EPA) concurs that the NOEL in the second study was determined to be 0.5 mg/kg/day.

Chronic Mouse Feeding Study

EPTC was fed in the diet to groups of mice to provide dosage levels of 0, 5, 20 and 80 mg/kg/day for two years. Signs of toxicity included decreased body weight and food consumption.

Carbon Disulfide

Carbon Disulfide (CS_2) is a clear, colorless, flammable liquid which is only slightly soluble in water (2,200 mg/l @ 22°C). The pure chemical boils at 46.3°C. Very little information could be found regarding its toxicity in liquid or solution form. (The oral toxicity to humans, LDL_0 is 14 mg/kg.) NIOSH, in its criteria document for CS_2 vapor (1977), recommended a TWA of 1 ppm, with a 10 ppm ceiling for any 15 minute period.

Thiocyanate

Thiocyanates are not normally dissociated into cyanide. They have a low acute toxicity. Sodium Thiocyanate (NaCNS) has an Oral LD_{50} for rats of 764 mg/kg.

Prolonged absorption may produce various skin eruptions, running nose, and occasionally dizziness, cramps, nausea, vomiting and mild or severe disturbances of the nervous system.

3 10 00333

JUN 0 3 '87
REC

ORDRAM®

(Common Name : Molinate)

Selective Herbicide

TECHNICAL DATA REVIEW

Written by :

G.J. Nohynek, PhD
Manager Environmental Services
Stauffer Chemical SA

December 1986

3 10 00334

CONTENTS

3 10 00335

Contents
(continued)

3 10 00336

1. INTRODUCTION

Ordram ®, containing the active ingredient molinate, is a selective thiolcarbamate herbicide for the control of grass weeds such as Echinochloa spp. in rice. Ordram is used as a emulsifiable concentrate, Ordram 6 E, containing 720 g active ingredient per litre, or as granular formulations containing 5, 7.5 or 10% active ingredient. Ordram is applied prior to planting followed by soil incorporation or post-flood, postemergence. Typical application rates are 3.0 - 4.0 of active ingredient per hectar.

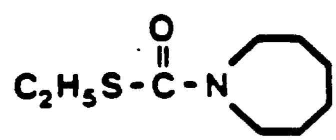
3 10 00337

2. IDENTITY

2.1 CHEMICAL NAME AND STRUCTURE

IUPAC Name : S-Ethyl hexahydro-1H-azepine-1-carbothioate

- CAS - Number : 2212 - 67 - 1
- Structure :



- Molecular Weight : 187.30
- Empirical Formula : $C_9H_{17}NOS$

2.2 Common Name

Molinate

2.3. Composition of Technical Product

Purity : minimum 95% (w/w)

2.4 Commercial Formulations

Ordram 6E : emulsifiable concentrate containing 720 g molinate/litre

Ordram 5,7.5,10 G: granular formulations containing 5,7.5 and 10% (w/w) molinate

3. PHYSICAL AND CHEMICAL PROPERTIES - Ordram technical

3.1 Physical Properties

3.1.1 Appearance : Clear, amber liquid

3.1.2 Melting Point : below - 30°C

3.1.3 Specific Gravity : 1.063 at 20°/20°

3.1.4 Boiling point : 202°C (extrapolated)

3.1.5 Vapor Pressure : 5.6×10^{-3} mmHg at 25°C

3.2 Chemical Properties

3.2.1 pH : 9.0 (4:4:2 Ordram/acetone/water)

3.2.2 Flash Point : 110°C (TOC)
93°C (TCC)

3.2.3 Solubility at 20°C :

Kerosene :	Miscible
Xylene :	Miscible
Acetone :	Miscible
Ethanol :	Miscible
Water :	970 ± 27mg/l

3.2.4 Partition Coefficient - Octanol/Water :

760 at 25°C

3.2.5 Hydrolysis and Solubility Study :

The solubility of molinate in deionized water at 25°C was determined to be 970 ± 27 mg/l. The results of the hydrolysis study indicatde that under the experimental conditions employed, i.e. at pH 5.0, 7.0 and 9.0 and at 25 and 40°C, no significant hydrolytic break-down of molinate occurred within a 30-day test period. (Stauffer, RRC 84-51, September 1984).

4. ANALYTICAL METHODS

4.1. Formulation Analysis

Active ingredient content of formulations is determined by means of a gas-liquid chromatograph equipped with a 6ft x 1/4 inch Pyrex glass column packed with 3% OV 17 on Gas Chrom Q 60-80 mesh, a linear temperature programmer and a flame ionization detector. Ro-Neet (cycloate) is used as internal standard. (Stauffer, WRC 75-1, 1975).

4.2. Determination of Crop Residues

Potential residues are extracted from plant samples by steam distillation and are determined by gas chromatography using a 10% OV 17 on 80-100 mesh Gas Chrom Q column and a flame photometric detector equipped with a 394 nm filter for specific response to sulfur compounds. The sensitivity of the described method is 0.01 mg/kg Ordram. (Stauffer, WRC 72-43, 1972).

4.3 Water Analysis

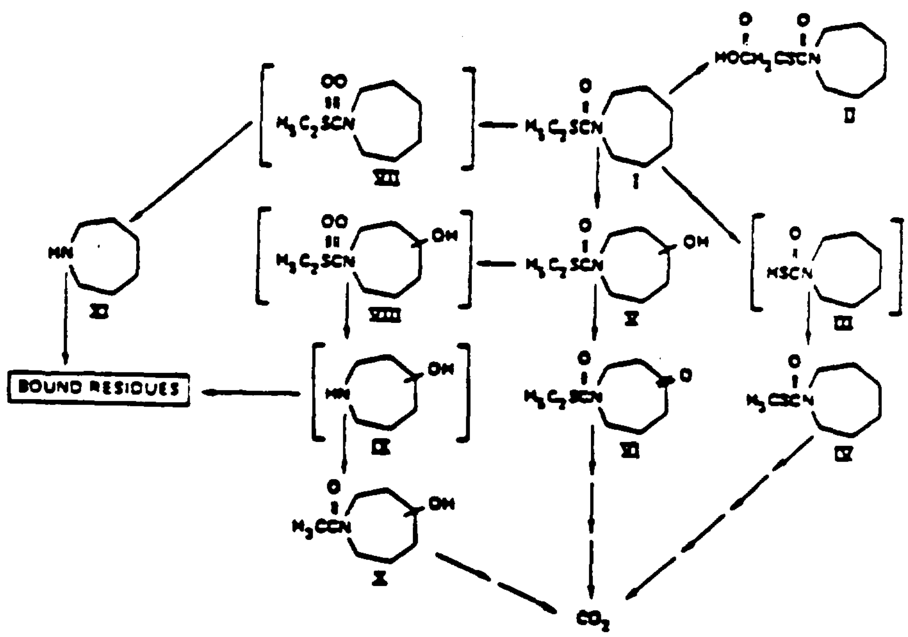
Ordram is extracted from the water sample with isooctane and determined by gas chromatography using an OV-17 column and a flame photometric detector in the sulfur mode. Sensitivity of this method is 10 µg/l. Use of an Amberlite XAD-2 macroreticular resin absorption column, subsequent elution with toluene and gas chromatography determination results in lower detection limit of 1 µg/l.
The sensitivity of both methods may be further improved by use of gas chromatography / mass spectrometry employing mass fragmento-

graphic detection resulting in a lower detection limit of 50 ng/litre. (Stauffer, RRC 75-13, 1975 and RRC 76-21, 1976).

5. BEHAVIOR OF ORDRAM IN SOIL, WATER AND PLANTS

5.1 Soil Persistence/Metabolism

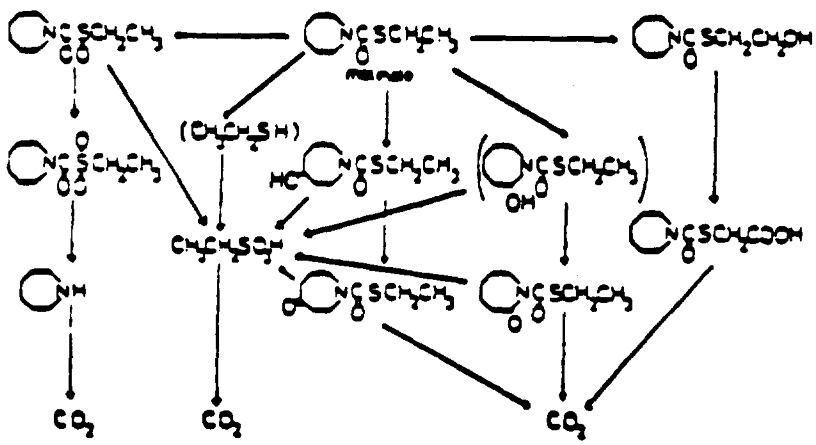
- In a laboratory study the degradation of ^{14}C-molinate in soil under flooded and nonflooded conditions was investigated. Under moist soil conditions 50% of the applied Ordram was lost within 3 weeks. Under flooded conditions, dissipation was reduced to 50% loss at 10 weeks. Under aerobic flooded conditions volatilization of was the primary mode of dissipation and little degradation occurred. In moist soils, degradation pathways induce hydroxylation of the azepine ring further oxidation to the respective ketone, oxidation to the sulfoxide and cleavage to yield the imine followed by further degradation reactions, resulting finally in evolution of $^{14}CO_2$:



(V.M. Thomas and C.L. Holt. 1980)

3 10 00341

- In a study on soil degradation of ^{14}C-molinate carried out by a Japanese group essentially similar results were found: rapid degradation under unflooded conditions (half-lives : 5-25 days, depending on soil type) and slower soil degradation under flooded conditions (half-lives : 40-160 days). The degradation pathway identified in this study included several routes, all of them resulting in total breakdown to $^{14}CO_2$:



Possible degredation pathways of molinate in soil.

(Imai and Kuwatsuka, 1982)

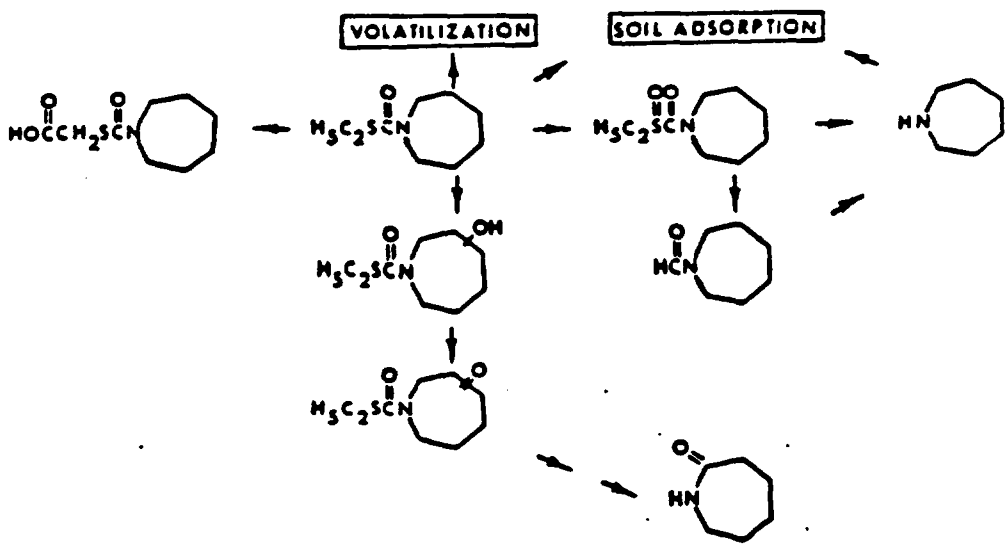
3 10 00342

5.2 AQUATIC DEGRADATION

The fate of [^{14}C] Ordram was studied in natural creek water, with and without a sediment layer of soil. From creek water alone (aerobic system), 50% of the applied ^{14}C dissipated in 9 days, while from creek water above sediment (anaerobic system) 50% of the radioactivity dissipated in 2 days. Eight weeks after treatment, most of the radioactivity disappeared from the water in both cases, but the sediment still contained 32.0% of the initial radioactivity, the majority of which (25.3%) was in a "bound" state. About 50% of the extractable radioactivity in the sediment at 8 weeks was shown to be undegraded Ordram.

In water without sediment, Ordram rapidly disappeared (not detected after 5 weeks). Many organo-soluble breakdown products were observed with the major products being identified as 4-hydroxy Ordram (42.1%) and 3-hydroxy Ordram (20.7%). In water with sediment, Ordram losses were more rapid than in the aerobic system. The major breakdown products were identified as 4-hydroxy Ordram (72.6%), 4-keto Ordram (14.1%) and 3-hydroxy Ordram (13.3%). The majority of the extractable radioactivity found in the sediment after 5 weeks (3.7%) was identified as parent compound.

After 8 weeks, only a few polar metabolites remained in the flood water held over sediment, with the major product (41%) identified as S-carboxymethyl hexahydro-1H-azepine-1-carbothioate (carboxy Ordram). After 6 weeks in the non-sedimented system, many polar breakdown products were detected of which hexamethyleneimine (28.9%) and carboxy-Ordram (16.2%) were major. Caprolactam was only detected in both systems the differences in polar metabolite concentrations were attributed to different adsorptive properties of the sediments. The following degradation pathway was proposed :



Proposed degradation pathway of Ordram in water.

(V.M. Thomas et al., 1981)

3 10 00343

5.3. DISSIPATION OF ORDRAM IN RICE FIELDS

Several reports have been published on this subject :

- In a study conducted in Californian rice fields commercially treated with molinate it was shown that the principal route of dissipation was volatilization, followed, by soil absorption photolysis, metabolism and plant uptake. The average half-life in the water was 3 days.
  The principal routes of molinate dissipation were estimated as follows :

Routes of Molinate loss from an Ordram-Treated Field:

Process	Estimated loss, %
Soil adsorption and metabolism	10
Plant uptake and metabolism	5
Aqueous microbial metabolism	1
Hydrolysis	1
Photolysis	5-10
Volatilization to atmosphere	75-85

(C.J. Soderquist et al., 1973)

- In an investigation conducted by Stauffer Chemical Company in small simulated rice paddies, the half-life of Ordram was 3.5 - 5.5 days and 97% of the applied material had disappeared 21 days after application. The initial water concentration was 2.63 - 2.93 mg/l decreasing to 0.006 - 0.08 mg/l after 21 days.
  (Gray et al., Stauffer Mt. View Research Center)

- In a study conducted 1975 in Texas, persistence and half-life were evaluated with respect to intermittent and contiouous flow irrigation schemes at normal and excessive application rates of 3.4 and 11.2 kg ai/ha of granular Ordram, respectively. Persistence at statistically significant levels ranged from 96 to 354 hours following the application. Half-life values averaged 96 hours in the intermittent flow plots and 54 hours in the continuous flow plots. Application rates had little effect on half-life. From laboratory studies these authors suggested that biological degradation was the principal mode of dissipation.
(L.E. Devel et al.,1978).

- In a field study carried out in France (Camargue) a field half-life of 3 days was measured. From initial values of 1.8 - 5.0 mg/l the water concentration stabilized in the vicinity of 10 µg/litre, a level it reached 25 days after application. (Podlejski, 1975).

5.4. OCCURENCE OF MOLINATE IN THE AQUATIC ENVIRONMENT

- In a USSR study, molinate concentrations of discharge water from rice fields were monitored : Peak concentrations of 7-10 µg/l occurred during June to drop to 0.5 - 1 µg/litre during August (Chubenko and Strekosov, 1976).

- Investigations conducted 1976 and 1978 by the Californian Central Valley Water Quality Control Board in cooperation with the State Department of Fish and Game monitored occurence of rice pesticides in drainage systems from rice growing areas. Peak concentrations of molinate were 0.30 - 1.8 mg/litre molinate which occurred 26 - 48 hours after application. Water Residues levelled to 0.2 - 0.55 mg/l 123 - 144 hours after application.
(Stauffer, Unpublished Draft Report, 1978).

- In an investigation in France measuring concentrations of several pesticides in effluent waters from rice fields molinate concentrations ranged from maximum 1.5 mg/l on day 2 after application to 0.14 mg/l on day 13 after application of the herbicide.
(Podlejski, 1978)

- A 3-year study conducted by a group of U.C. Davis, California, in experimental rice paddies monitored molinate concentrations in spill-waters from a flow-through water managment system : water residues ranged from 1.5 mg/litre on day 0 to 0.1 mg/litre 3 days after application.
(Tanji et al., 1974)

5.5. LEACHING BEHAVIOR OF MOLINATE

In laboratory column leaching experiments using 5 different soil types.i.e. loamy sand, sandy loam, loam, clay and peat soils and irrigation with 200 mm water, molinate was shown to leach to a depth of 30-40 cm in the two light soils. In heavier soil leaching depth did not exceed 7.5 cm. (Gray and Weierich, 1965). In field studies, no molinate was found in soil cores taken from 2,5 - 50 cm and 17.5 - 20.0 cm soil depth. (Denel et al., 1975). A soil adsorption/ desorption study conducted by Stauffer using loamy sand, silty clay and loam soils resulted in identification of adsorption coefficients from 0.72 to 3.03. Molinate soil adsorption is correlated with increasing cation exchange capacity (Thomas and Holt, 1975)

The results of the leaching and adsorption studies indicate that molinate shows little or no tendency to leach in heavy soils and soils with high cation exchange capacity. Limited leaching may be expected in light, sandy soils with low cation exchange capacity.

5.6. METABOLISM AND DEGRADATION IN PLANTS

After application of both chain-labelled Ordram-C^{14} and ring-labelled Ordram-C^{14} to the roots of rice plants at a rate of 6.7 kg/ha, radioactive carbon dioxide was rapidly evolved from the plants. In six days after application, 4.0% of the applied chain-labelled Ordram was evolved as radioactive carbon dioxide. In thirteen days after application of the ring-labelled Ordram to the roots, 11.4% of the applied radioactivity was evolved as carbon dioxide. Apparently the cyclic imine ring of Ordram was broken open, degraded into small fragments and evolved as CO_2.

The alkyl chain was also broken down and converted into CO_2. The cell sap from the roots and shoots of the treated rice plants was analyzed by one-dimensional and two-dimensional paper chromatography followed by scanning the chromatographs for radioactive components and preparing autoradiographs of them. These analyses showed the presence of seven radioactive amino acids as metabolites of chain-labelled Ordram-C^{14} in rice plants. These radioactive amino acids were identified as asparagine, glycine, threonine, alanine, tryptophane, phenylalanine and isoleucine. Several organic plant acids including lactic acid, glycolic acid and three other unidentified organic acids were also found as radioactive metabolites of chain-labelled Ordram-C^{14} in rice plants.

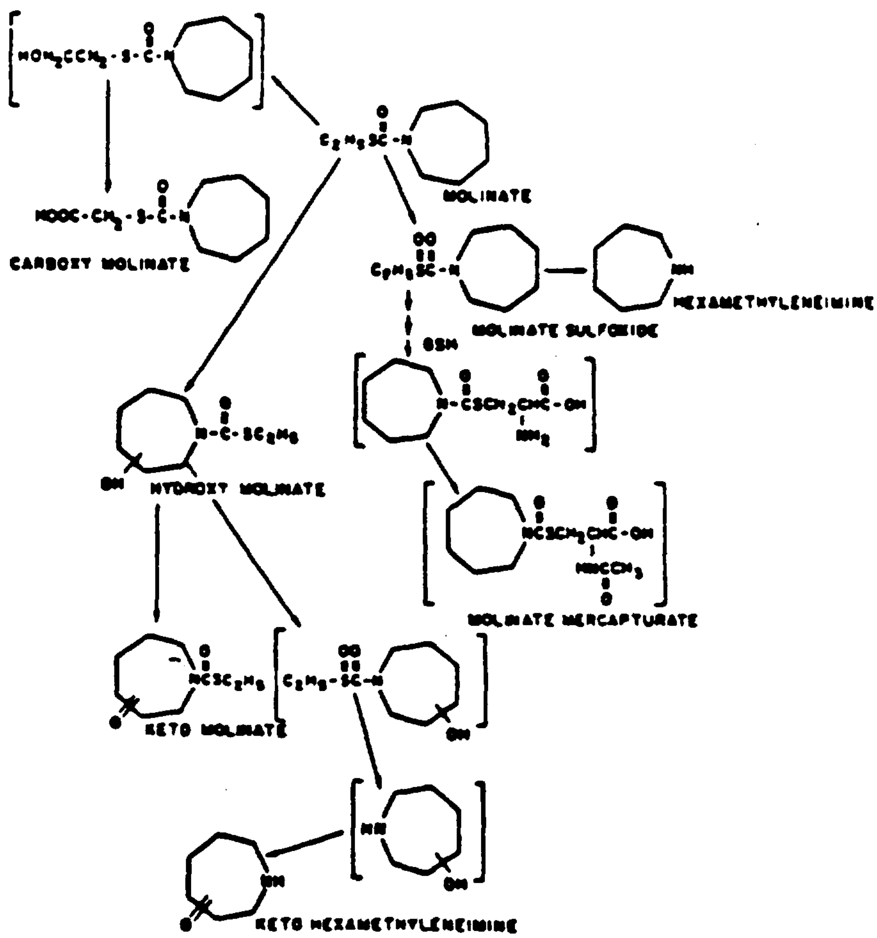
Cellulose and other water insoluble materials from the roots and leaves of rice plants became highly radioactive in just three days after treatment with either the chain-labelled or the ring-labelled Ordram-C^{14}. The proteins in the cell sap also became labelled with carbon-14. Ring-labelled Ordram was also broken down in rice plants and the radioactivity was found in several amino acids and organic acids. These findings indicated that both the chain-labelled and ring-labelled Ordram-C^{14} were rapidly metabolized in rice plants, degraded into small fragments, converted into radioactive carbon dioxide, amino acids, organic plant acids related to the Krebs cycle, proteins, and cellulose. Thus, most of the radioactivity of the metabolites of Ordram-C^{14} was accounted for in these various natural plan constitutents.
(Gray, 1969)

3 10 00347

6. METABOLISM OF ORDRAM IN FISH AND MAMMALS

6.1 Metabolism in Japanese Carp

The fate of the herbicide, molinate, in Japanese carp, (*Cyprinus carpio*) var. Yamato koi, was investigated. [Ring-^{14}C] molinate was applied to the water at 0.2 ppm. The overall ^{14}C residues in tissues of fish were low with an average bioaccumulation value of 1.35% during 1- to 14-days exposure. Molinate disappeared rapidly from water containing the carp. It accounted for only 3.8% of the extracted radiocarbon present in the water 14 days after treatment. Molinate was readily converted into various organosoluble and water-soluble degradation products shortly after addition to the water. Molinate sulfoxide, ring-hydroxylated molinate, isomers of keto molinate, keto hexamethyleneimine, hexamethyleneimine, and other metabolites were detected both in the water and/or fish bile. Polar metabolites, but no unchanged molinate, were found in the bile. *In vitro*, carp liver microsomal mixed-function oxidase systems also produced organosoluble metabolites identical to those found in the water containing living fish. The data suggest that major metabolic pathways for molinate in carp involve sulfoxidation, oxidation to both hydroxy and keto derivatives, and possible conjugation involving carbamoylation of endogenous SH-groups and O-conjugation of HMI.



Proposed metabolism of [ring-^{14}C]-molinate by carp *in vitro* and *in vivo*.

6.2 Metabolism in the Rat

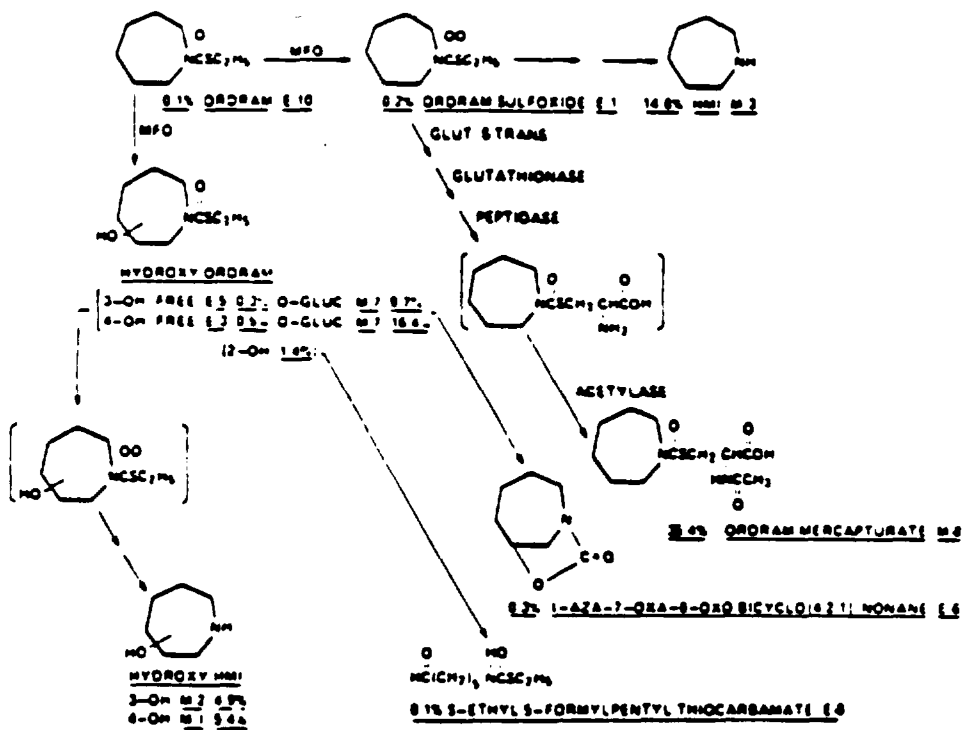
6.2.1 Balance and Tissue Residue Study

Excretion of ^{14}C after administration of [ring-^{14}C] Ordram, S-ethyl hexahydro [2-^{14}C] azepine-1-carbothioate, to rats was rapid, with approximately 97% of an oral dose (72 mg/kg) being excreted within 48 h after dosing. The major routes of excretion were via the urine (85%, urine + cage wash) and feces (11%). Less than 1% of the dose was detected in the sodium hydroxide air traps. No significant differences were observed between the rates and routes of excretion from male and female rats. Similarly, no significant differences in residual tissue ^{14}C attributable to sex effects were observed. With the exception of blood, residues associated with most tissues substantially decreased over the 7-day period after dosing. Whole-body residues decreased from an average of 13.8% of the administered ^{14}C at 1 day to 3.7% after 7 days. Seven-day blood residues were dose dependent, decreasing markedly from 40.1 ppm Ordram equivalents at a relatively high dose of 60 mg/kg to less than 1 ppm at a dose of 5 mg/kg.
(De Baun, 1975 A).

6.2.2 PATHWAY OF METABOLIC DEGRADATION

Ordram (S-ethyl hexahydroazepine-1-carbothioate) is readily degraded by the rat to more polar products which are excreted primarily in the urine. Unchanged Ordram accounts for only 0.1% of the urinary ^{14}C after an oral dose (72 mg/kg) of [ring-^{14}C] Ordram. The major metabolic pathway involves sulfoxidation and conjugation with glutathione, giving rise ultimately to a mercapturic acid derivative which accounts for 35.4% of the urinary ^{14}C. Ring hydroxylation to give the 3-and 4-hydroxy-Ordram derivatives (0.8% free, 26.1% as O-glucuronides) represents another major metabolic route. Hydroxylation in the 2 position of the ring and subsequent ring cleavage represent a minor pathway. Hexamethyleneimine (14.6%) and 3- and 4-hydroxyhexamethyleneimine (10.3%) are major metabolites presumably formed by hydrolysis of sulfoxidized Ordram and its hydroxy derivatives. Although there are small quantitative differences, the metabolism of [ring-^{14}C] Ordram in female and male rats is qualitatively the same.

The following metabolic pathway has been proposed :



Proposed metabolism of [ring-^{14}C] Ordram in the rat. Percentage are average values for female and male 0-48 h urine after oral dosing with 72 mg/kg. Expressed as percent urinary ^{14}C.

(De Baun, 1978 B)

7. TOXICOLOGICAL INVESTIGATIONS

7.1. Acute Toxicity

7.1.1 Ordram, technical

Ordram technical has been evaluated for acute toxicity properties in numerous studies with the following results :

Study		Results
Acute oral LD_{50}, male rat	:	794 - 926 mg/kg
Acute oral LD_{50}, female rat	:	501 - 1260
Acute oral LD_{50}, male mouse	:	795 mg/kg
Acute dermal LD_{50}, rabbit	:	> 4640 mg/kg
Eye irritation, rabbit	:	Slight to Moderate. Reversible Irritant
Skin Irritation, rabbit	:	Mild to Moderate Irritant
Acute Inhalation Toxicity :		
4-hour LC_{50}, male rat	:	2.9 mg/l
4-hour LC_{50}, female rat	:	2.4 mg/l
4-hour LC_{50} male mouse	:	2.1 mg/l

(Stauffer Chemical Company Toxicology Dept.: T-1402A. T-1402B, T-1646, T-1719, T-1870, T-4401, IRDC / T-6242, T-6598A)

7.1.2 Signs and Symptoms of Acute Oral Intoxication

Within several minutes following dosage of 1000 and 2150 mg/kg Odram tech., rats appeared depressed and ataxic and exhibited salivation, excessive masticatory movements and lacrimation. At levels of 1000 mg/kg the animals appeared extremely weak and depressed, exhibiting ataxia, intermittent tremors, bloody

3 10 00351

exudate around the eyes, signs of excessive urination, labored respiration and hypothermia. These symptoms reached maximum intensity at 24 hours after administration and persisted up until death or disappeared within 72 hours.
Cross autopsies revealed congested and hemorrhagic lungs.

7.1.3 Acute Toxicity of Ordram Formulations

Formulation	Formulation * Type	Study	Results
Ordram 5 E	(960 g/l) EC	Oral LD_{50}, male rat	794 mg/kg
Ordram 5 E		Oral LD_{50}, fem. rat	926 mg/kg
Ordram 5 E		Dermal LD_{50}, rabbit	3563 mg/kg
Ordram 5 E		Dermal Irritation, rabbit	Moderate Irritant
		Eye Irritation, rabbit	Moderate Irritant
Ordram 6 E	(720 g/l) EC	Oral LD_{50}, male rat	794 mg/kg
Ordram 6 E		Oral LD_{50}, fem. rat	651 mg/kg
Ordram 6 E		Oral LD_{50}, male mouse	1260 mg/kg
Ordram 6 E		Dermal LD_{50}, rabbit	10000 mg/kg**
Ordram 6 E		Eye Irritation, rabbit	Moderate Irritant
Ordram 6 E		Dermal Irritation, rabbit	Moderate Irritant
Ordram 6 E		Acute 1-hour inhalation LC_{50}	> 2.1 mg/l
Ordram 10 G	G	Acute oral LD_{50}, rats	> 5000 mg/kg**
		Acute dermal LD_{50}, rabbit	> 5000mg/kg**
		Eye Irritation, rabbit	Mild Irritant
Ordram 7.5 G	G	Oral LD_{50}, male rat	> 4640mg/kg**
		Oral LD_{50}, fem. rat	> 4640mg/kg**
		Dermal LD_{50}, rabbit	> 4640mg/kg**

* EC = Emulsifiable Concentrate; G = Granular

** Highest Dose Tested

(Stauffer Toxicology Reports T-4956, T-4971, T-64-10, T-65-6, N-3548).

7.2. Dermal Sensitization

The dermal sensitization potential of Ordram Technical was tested using the Open Epicutaneous Test (OET). The test animals, Hartley guinea pigs, were induced over a four week period and challenged on day 29 and day 43. Concentrations of Ordram Technical used for the daily induction application ranged from 3 to 100%. Each animal was challenged with 100, 30, and 10% Ordram Technical, as well as vehicle. There were no apparent adverse effects of Ordram Technical to the guinea pigs, as measured by weight gain, general appearance of behavior.

Repeated application of Ordram Technical did not cause any notable skin reaction during the induction phase. Challenge and rechallenge with Ordram Technical did not produce positive skin reactions in guinea pigs induced with this material. In contrast, the positive control material, DNCB, produced sensitization at both challenge and rechallenge.

In conclusion, Ordram Technical did not produce dermal sensitization in the OET and has therefore none or very low sensitization potential.
(T.R. Castles, Stauffer Chemical Co., T-12007, August 1955).

7.3 Subacute/Subchronic Toxicity Evaluations

7.3.1 Ordram 6 E: 21-Day Subacute Dermal Toxicity in Rabbits

A total of 15 daily dermal doses of undiluted Ordram 6-E appeared well tolerated by male and female albino rabbits at a level of 0.1 ml/kg/day. Moderately irritating to both intact and abraded skin, these signs rapidly subsided within a two week post-treatment observation period.

A level of 1.0 ml/kg/day proved to be toxic to rabbits, resulting in 90% mortality (18 of 20 animals) during the course of the study. Typical of the response were severe skin irritation with secondary infection, anorexia, diarrhea and weight loss. Apparent liver pathology and an abnormal blood picture accompanied several animals.
(G. Meyding, Stauffer Chemical Co., Rep. 64-3, 1964)

7.3.2 **Ordram : Safety Evaluation by Dietary Administration to Dogs for 13 weeks.**

Groups of 4 purebred Beagle dogs received daily diet containing 450, 900 and 1500 ppm Technical Ordram corresponding to an approximate daily intake of 15,30 and 60 mg/kg body weight over a period of 13 weeks.

No measurable changes were observed in the dogs of the 15 and 30 mg/kg/day groups. In the group of dogs exposed to 60 mg/kg/day Ordram the following observations were recorded :

-Slight increase in blood area nitrogen content in 1/4 days.

-Slightly increased thyroid weights in 3/4 dogs.

450 ppm. corresponding to 15 mg/kg/day was considered as the NOEL under conditions of this study.
(Woodard Research Corporation, Nov. 1964).

7.3.3 **Ordram - Safety Evaluation by Repeated Oral Administration to Rats for 13 weeks.**

Groups of 15 male and 15 female Charles River rats were administered for 13 weeks diets containing Ordram levels adjusted to daily intakes of 35.70 and 140 mg/kg/day. In the 35 mg/kg/day groups slightly reduced food intake body weight gain was recorded. No other changes when compared to controls were observed at this dose level.

At doses of 70 and 140 mg/kg Ordram produced marked toxicity, expressed as :

- Marked body weight reduction and food intake

- Decrease in hemoglobin and hematocrit values at the high-dose males.

- Increased relative liver, kidney, adrenal, thyroid, testes and ovary weights at high-dose and sometimes at mid-dose level.

- Histopathological findings included at high-dose hepatic cell glycogen depletion, hepatic cell size irregularity, kidney nephron tubular degeneration in the high-dose males, concurrent with testes degenerative seminiferous tubule cell changes and aspermatogenesis.

Under conditions of this study, a precise NOEL could not be defined. (Woodard Research Corporation, October 1964)

7.3.4 <u>Ordram - Safety Evaluation by 13-Week Feeding Study in the Rat</u>

Groups of 15 male and 15 female Charles River Rats were administered a diet containing Ordram at levels adjusted to correspond to a daily intake of 6,16 and 32 mg/kg/day.

At the high and mid-dose levels the following observations were made :

- Reduced body weight and food intake at high dose.

- Increases in relative adrenal, thyroid, testes weights in the males and adrenal/thyroid weights in the females at high dose.

- Ovarian stromal cell vacuolation in mid-and high-dose females and adrenal cortical cell vacuolation in mid-and high-dose males.

No changes, when compared to controls were observed at 8 mg/kg day and this level was considered the NOEL in this study. (Woodard Reserarch Corporation, April 1967).

3 10 00355

7.4. Chronic Toxicity/Oncogenicity

7.4.1 Ordram - Repeated Oral Administration to Mice for Lifetime

Groups of 20 male and female CAF1 hybrid mice were administered for 99 to 100 weeks a diet containing Ordram corresponding to a daily intake of 3.6, 7.2 and 14.6 mg/kg/day. Additional groups consisting of 36 male and 28/25/31 female CAF_1 mice were exposed in utero and through weaning via parental dietary administration and were continued for 76 to 78 weeks on respective dietary levels of 3.6, 7.2 and 14.4 mg/kg/day.

The conclusions of the study were as follows :

Ordram produced no neoplastic changes as revealed by the histological examination of lung, liver, kidney, testis, ovary, and uterus as well as all other tissues appearing abnormal at necropsy. No compound-induced non-neoplastic changes in these same tissues were observed by similar examination. Groups could also not be distinguished on the basis of growth, behavior, body weights, food consumption, organ weights and gross necropsy evaluations. Survival in the high dose mice exposed in utero may have been slightly reduced. The other groups were indistinguishable with respect to survival. Based on the data presented in this study, the no-effect level of Ordram is 7.2 mg/kg/day. (Woodard Research Corporation, June 1977).

7.4.2 Ordram - Safety Evaluation by Repeated Oral Administration to Rats for 104 Weeks.

Groups of 60 male and 60 female Fisher Rats were administered for 2 years dietary concentrations of Ordram corresponding to daily intakes of 8, 16 and 32 mg/kg for the first 18 weeks, followed by dose adjustion to 0.63, 2.0 and 6.32 mg/kg for the remainder of the study. Reduction of dosage was justified by appearence of weight less jeopardizing survival over the study period.

At termination of the study the following observations were recorded in the high-dose (6.32 mg/kg/group) :

Slight initial and intermittent reduction in food consumption and weight gain, increased absolute and relative testicular and decreased relative kidney weights. No differences were found concerning behavior, survival, clinical chemistry values and urine analysis, hematology, gross necropsy and histopathological evaluations. No changes attributable to compound administration were recorded at the mid-dose and low-dose level with the exception of silghtly increased testicular weights.

No indications for compound-related induction of neoplastic lesions or non-neoplastic lesions were observed during the histopathological evaluations of the tissues. It was concluded that Ordram has no oncogenic activity and that the NOEL at 2-year dietary administration to Fisher rats is 0.63 mg/kg/day. (Woodard Research Corporation, June 1977).

7.5. REPRODUCTIVE TOXICOLOGY

7.5.1 TERATOLOGY STUDY IN MICE

Groups of 20 pregnant mice were exposed to dietary administration of technical Ordram corresponding to a daily intake of 8 and 24 mg/kg from day 6 of gestation to termination (groups II and III) and during days 6-15 of gestation (groups IV and V). On day 18 of gestation Cesarian Section was performed on 10 females/group, the remainder being permitted to deliver naturally.

No signs of maternal toxicity was observed in respect of behavior, body weights, food consumption and gross necropsy observations. No changes were monitored in total number of fetuses, fetal development, resorption sites ahd fetal weights. Evaluation of cesarean-derived fetuses and naturally delivered pups resulted in no indications of soft-tissue and sceletal malformations. It was concluded that Ordram was nonfetotoxic and nonteratogenic under conditions of this study with a NOEL of 24 mg/kg/day when administered over gestation.
(Woodard Research Corporation, April 1967).

7.5.2 Teratology Study in Rabbits

This study was conducted to assess the effects of Ordram on the pregnant rabbit and unborn conceptuses when administered to dams from day 7 through day 19 of gestation. Ordram was administered by oral gavage at levels of 0, 2, 20, or 200 mg/kg/day in 0.5 ml/kg in corn oil. Data collected included clinical observations, body weights and feed intakes. Necropsy findings included maternal organ weights, counts of corpora lutea, implants resorptions, fetuses and anomalies detected in fetuses on external, soft tissue, or skeletal examinations.

Maternal toxicity occurred in the 200 mg/kg/day dose group as indicated by significant body weight losses during gestational days 14-21 and increased absolute and relative liver weights. The relatively large body weight losses in these dams were associated with an increased occurrence of abortions and a resorbed litter. Embryofetotoxicity at the 200 mg/kg/day dose level was also indicated by a slight delay in sternebral ossification and a reduction in extra ribs. Embryofetotoxicity observed in the 200 mg/kg/day dose group was secondary to the maternal toxicity.

Therefore, treatment of pregnant dams with 200 mg/kg/day of Ordram during gestation caused maternal and embryofetotoxicity. The no-effect level for maternal and embryofetotoxicity was 20 mg/kg/day. No teratogenic effects were observed at any dose level.
(S.L. Wilczynski, Stauffer Chemical Co., T-11566, June 1985)

7.5.3 3-Generation Reproduction Study in Rats

Groups of 25 male and 25 female Charles River CD rats were administered dietary concentrations of Ordram over a 3-generation, 2-mating/generation study using doses corresponding to average daily intakes of 0.063, 0,2 and 0,63 mg/kg.

No changes were noted in all groups concerning food consumption, organ weights, reproductive behavior, gross necropsy and histopathological evaluations. The body weight of the high-dose males was slightly reduced. In the high-dose group (0.63 mg/kg/day) there was a slight reduction of litter numbers but not of litter sizes concurrent with slight reduction of pup survival. No pup weight reduction and no indications for pup abnormalities were observed. The NOEL level of this study was 0.2 mg/kg/day.
(Woodard Research Corporation, 1975).

7.5.4 Male/Female Fertility Study in Rats

Groups of 8 male and female rats were administered a diet over 12 weeks containing Ordram levels corresponding to a daily intake of 8, 16 and 32 mg/kg. After 12 weeks each animal was mated to an untreated control animal that was kept over the same period under identical housing conditions. The results of this study indicated no reproductive effects following mating of untreated males with treated females. Mating of treated males with untreated females resulted in reduced reproductive performance.
(Woodard Research Corporation, May 1975).

7.5.5 Fertility Study in Male Rats

Groups of 20 male rats received dietary daily doses of 0.2, 1.0 and 5.0 mg/kg for nine days and 5,0 mg/kg per gavage for 14 days. 10 and 14 days after initiation the males were mated with untreated females; the 5.0 mg/kg group males at 2 and 4 weeks after end of treatment period. Slightly reduced reproductive performance was observed two weeks after cessation of Ordram at 5.0 mg/kg, with recovery 4 weeks after treatment. No effects were observed at lower doses.(Litton Bionetics Inc., Project No 2621, 1976)

7.5.6 Fertility Study in Rabbits

Thirty-seven male, Dutch Belted rabbits of proven fertility were assigned to four dose groups. There were 10 males in the vehicle control group and 9 males each in the 2, 20, and 200, mg/kg dose groups. The test material was administered daily for 6 weeks in gelatin capsules. Male fertility was determined by mating each male with 2 untreated females during the sixth week of the dosing period and again in the fifth week of the recovery period. Five control males and four treated males from each of the treatment groups were sacrificed at the completion of dosing. The remaining males were sacrificed at the completion of the postrecovery fertility test. The testes plus epididymides, pituitaries, thyroids plus parathyroids, and adrenals were weighed, collected, and submitted for histopathology.

No evidence of impaired fertility was found. There were no treatment-related effects on mating behavior, number of pregnancies, mean number of pups/litter, mean weight/pup, length of gestation, or the mean number of viable pups/litter.

Necropsy results from the interim and final sacrifices revealed no treatment-related macroscopic lesions. There were no treatment-related changes in the mean weights of the testes plus epididymides, pituitary, thyroids plus parathyroids, or adrenals. There were no histological changes with an incidence or severity pattern related to the administration of Ordram.

It was concluded that administration of Ordram at doses up to 200 mg/kg/day over 6 weeks to male rabbits induces no negative effect upon reproductive performance and fertility.
(J. Killinger, Stauffer Chemical Co., T-10176, Nov. 1980).

7.5.7 Fertility Study in Nonhuman Primates

The effect of Ordram on nonhuman primate sperm production and reproductive hormone levels was investigated. Adult male cynomolgus monkeys(Macaca fascicularis) were treated orally with 0, 0.2, 10.0, or 50.0 mg/kg/day of Ordram five days a week for twelve weeks. Sperm samples were collected and analyzed weekly. Blood samples were collected and analyzed every four weeks.

There were no treatment-related changes observed in sperm sample motility, morphology, volume, concentration, or total count. Also, there were no treatment-related changes in serum luteinizing hormone, follicle stimulating hormone, or testosterone. There was a significant depression in plasma cholinesterase activity in the 50.0 mg/kg dose group indicating that Ordram was well absorbed. Thus, Ordram did not cause any measurable effects on nonhuman primate sperm production or reproductive hormone levels.
(J. Killinger, Stauffer Chemical Co., T-10714, Dec. 1981).

7.5.8 Fertility Study in Male Mice

One hundred male, CD-1 mice of proven fertility were randomized into five dose groups; vehicle control, 2, 20, 100, and 200 mg/kg/day. The males were dosed daily by oral gavage for 7 weeks. Fertility was determined by mating each treated and control male with 2 untreated females after 2, 4, and 6 weeks of treatment and again after a four-week recovery period. An interim sacrifice was performed on 5 males/group at the completion of dosing and a final sacrifice was performed on the remaining males after the end of the recovery period. Testes plus epididymides were weighed. The thyroids, pituitaries, testes and epididymides were collected and subjected to microscopic examination.

Treatment-related antifertility effects were observed. After 2 weeks of dosing, there were significant decreases in the number of pregnancies and in the number of implants per pregnancy in the 100 mg/kg group. After 4 and 6 weeks of dosing, there were significant decreases in the number of pregnancies and in the number of implants per pregnancy in the 100 and 200 mg/kg groups. The study clearly shows a no-effect level of 20 mg/kg for the observed antifertility effects. No antifertility effects were observed in the fertility test after the four-week recovery period, demonstrating complete reversability. Ordram did not cause macroscopic changes in the testes or other organs. Necropsy results from both the interim and final male sacrifices showed no dose-related lesions. There were no dose-related changes observed in the mean testes plus epididymides weights from either the interim or the final sacrifice. There were no histological changes indicative of a compound-related effect on the testes, epididymides, thyroids or pituitaries in any treatment group. While treatment-related antifertility activity was observed at relatively high doses (100 and 200 mg/kg/day), no tissue changes occurred as a result of Ordram treatment, determined by microscopic examination.

(J. Killinger, Stauffer Chemical Co., T-10121, Dec. 1980).

7.5.9 Fertility Study in Male Rats-Mechanism and Site of Action

The site and mechanism of Ordram's antifertility effect in male rats, particularly the stage of sperm development affected, was investigated. The study was composed of 4 parts which contained 3 experimental designs linked together by a common dose level.

In part I, male rats received either 0, 12, or 60 mg/kg of Ordram for 5 days, after which they were mated with 1 female per week for 10 weeks. The results of this study phase identified late spermatid development as the stage of spermatogenesis sensitive to Ordram exposure. This is concluded from the substantial reduction in male fertility during the third post-treatment week.

In part II, III, and IV, male rats were treated with either 0, 0.2, 4, 12, or 30 mg/kg of Ordram for either 5 or 10 weeks, after which they were mated with 2 females per week for either 1 or 2 weeks. At terminal sacrifice, blood, sperm samples, and reproductive tissues were taken for evaluation. A correlation was made between dose, changes in plasma hormone levels (testosterone, FSH, LH, TSH, T_3 and T_4), sperm morphology, motility, and viability, and morphologic changes in the testes and epididymides.

There were no measurable treatment-related changes in serum hormone concentrations which correlated with the reduction in male fertility. The dose-response relationship observed for male fertility could be correlated with changes in sperm viability, morphology, motility, and concentration. Histological examination of the testes and epididymides revealed a slight increase in degenerating spermatids. Generally, only a few tubules were involved and often only a small portion of the tubule was affected.

In part I, the no-effect level was shown to be 12 mg/kg/day of Ordram for 5 days. In part III and IV, a clear dose-response relationship could be shown at 4, 12, and 30 mg/kg/day, whereas treatment with Ordram at 0.2 mg/kg/day did not result in a measurable toxicological response. Therefore, 0.2 mg/kg/day of Ordram for 5 weeks is the no-effect dose in this study. (J.L. Minor, Stauffer Chemical Co., T-10421, May 1981)

3 10 00362

7.6. Special Toxicological Investigations

7.6.1 Study on Coagulation Parameters, Hematology and Blood Chemistry in Male and Female Rats Exposed to Ordram

The purpose of this study was the determine dose and time/response relationships in coagulation parameters in groups male and female rats administered daily doses of 5, 20, 80 and 160 mg/kg for 12 days. Blood parameters were evaluated after 4 (5), 11 (12) and 20 (21) days of study.

A mild and reversible coagulopathy was produced in male and female rats at a dose level of 160 mg/kg as evidenced by slight increases in APTT and by slight decreases in Factor X at day 4. These values had returned to normal by day 12 in the females and day 21 in the males. There were no mortalities and no abnormalities noted in the hematological and blood biochemical data.

The only adverse gross observations noted were (1) a mild to severe hind-limb weakness which was dose related and reversible in spite of continued treatment and (2) a mild to severe inhibition of body weight gain in both male and female rats. The latter was also dose related and varied from 6% at 20 mg/kg/day to about 40% at the 160 mg dose level. At autopsy slight to moderate hemorrhage was noted in 4/5 male rats at day 4 and in only 1/5 male rats at day 12. At termination at day 21 all male rats appeared normal at autopsy.

In summary, Ordram can produce a mild coagulopathy at very high doses, 160 mg/kg/day which reversed despite continued dosing. The no effect level in the experiment was 80 mg/kg/day for both male and female rats.
(Stauffer Chemical Co., RRC, T-6216, June 1977).

7.6.2 Toxicity to Cattle Sheep and Chicken

In a study conducted by the U.S. Department of Agriculture 3 cattle (age 9 to 16 months) were administered 10 daily doses of 100, 100 and 250 mg/kg. 10 sheep received 10 daily doses of 25, 25, 50, 50, 100, 100, 175, 250, 375 and 500 mg/kg. Groups of 5 chicken were dosed with 100, 250 and 500 mg/kg for 10 days.

Signs of poisoning in cattle and sheep were salivation, anorexia, diarrhea, and ataxia. One sheep had tympanites and another had lethargy and muscular spasms.

3 10 00363

At necropsy, the mucosa of the abomasum and intestines was hemorrhagic and lymph nodes were congested. The liver was swollen and often light brown. The spleen was distended and the kidneys were engorged with blood. The respiratory mucosa was often reddened and the thyroid was congested. Chickens had swollen, congested kidneys, light-brown liver, distended gall bladder, and reddened intestinal mucosa.

The NOEL in this study for cattle, chicken and sheep was 100, 100 and 100 mg/kg, respectively.
(J.S. Palmer, 1972).

7.7. Mutagenicity Evaluations

7.7.1 Ames Test

Ordram was evaluated for its potential to induce reverse mutations in the *Salmonella typhimurium* strains TA-1535, 1537, 1538 and TA-100 in presence and absence of a rat liver S 9 metabolic activation system. No indication for mutagenic potential was observed in either strain both in presence and absence of metabolic activation.
(Woodard Research Corporation, May 1975)

7.7.2 Ames Test/ Saccharomyces Cerevisiae D 4 Test

Ordram Technical was tested for mutagenic activity in *S. thyphimurium* strains TA-1535, TA-1537, TA-1538, TA-98, TA-100 and in Saccharomyces Cerevisiae D 4 both in presence and absence of a rat liver S 9 metabolic activation system.

No genetic activity was observed for any of the microbial indicator strains in direct or activation plate tests.
(Litton Bionetics Inc, Project No 2547, July 1975)

7.7.3 Mutagenicity Battery - Institute of Environmental Toxicity / Japan

The genotoxic potential of molinate was investigated in the following test systems :

- Rec Assay using *Bacillus subtilis* strains H 17 and M 45

- Ames test using S. typhimurium TA-1535, TA-1537, TA-1538, TA-98, TA-100 in presence and absence of metabolic activation.

- Escherichia coli WP 2 hcr in presence and absence of metabolic activation.

- Host-Mediated Assay in male mice using 2 doses of 30 and 100 mg/kg and S. typhimurium G 46 as indicator strains.

No indication of mutagenic / genotoxic potential was observed in any of these test. while the respective positive control substances induced reproducible responses of the test systems. It was concluded that molinate has no or very low mutagenic potential.
(Y. Shirasu et al. Institute of Environmental Toxicology, Sept. 1977).

7.7.4 Mouse Lymphoma L 5178 TK +/- Forward Mutation Assay

Ordram Technical was incubated with Mouse Lymphoma L 5178 cells directly in a dose range of 0.0125 - 0.28 µl/ml and in presence of a rat liver S 9 metabolic activation system.

No mutagenic activity was observed in absence of metabolic activation. In presence of the S 9 system, mutant incidence was marginally increased (2x-5x) toxic at dose levels resulting at < 10% cell survival. However, following current interpretation of the Mouse Lymphoma Test System, only mutant incidence of more than 3x is considered as a mutagenic response if occurring at toxic doses inducing less than 10% cell survival (Clive et al. 1979). It may therefore be concluded that Ordram has low or marginal mutagenic activity in presence of S 9 under conditions of this assay. (J.B. Majeska, Stauffer Chemical Company, T-11840, Sept. 1984).

7.7.5 Combined In-Vitro Cytogenetic and SCE Assay in Mouse Lymphoma L 5178 Y cells

Ordram Technical was evaluated for its ability to induce chromosomal aberrations or an increase in sister chromatid exchanges in L5178Y mouse lymphoma cells.

In the direct assay, Ordram Technical was tested in the dose range of 0.0125 to 0.2000 ul/ml. With the inclusion of an exogenous metabolic activation system from Aroclor 1254 induced rat livers, Ordram Technical was more toxic, and the dose range was decreased to 0.0025 to 0.0400 ul/ml.

No increase in aberrations or SCE was seen in the direct assay.

In the presence of an activation system, there was a slight increase in aberrations in one out of 4 tests. This response does not meet the criteria for a positive response, and there was no increase in aberrations in the other trials.

In the SCE portion of the assay, no reproducible increase was seen in the presence of an activation system. In Trial 1, the apparent increase at the low dose was influenced by the large variation in solvent control values. A minor increase in SCE at 0.02 and 0.04 ul/ml in Trial 2 was not reproduced in either Trial 1 or Trial 3.

It may therefore be concluded that Ordram Technical is neither clastogenic nor an inducer of SCE in L5178Y mouse lymphoma cells when tested directly or in the presence of an Aroclor 1254 induced rat liver activation system.
(J.B. Majeska, Stauffer Chemical Co. T-11856, Dec. 1983)

7.7.6 Bone Marrow Micronucleus Test in Mice

Ordram was evaluated for its ability to induce micronuclei when administered by oral gavage to mice.

The results of an initial rangefinding study indicated no survival at doses of equal to or greater than 800 mg/kg administered in a single dose. Two consecutive doses of 400 mg/kg administered approximately 24 hours apart did not appear to affect the animals. With a single dosing of 600 mg/kg, there was a reduction in surviving animals; the female animals were apparently more sensitive to Ordram than the male animals. A reduction in PCE frequency (PCE/1000 erythrocytes) was seen at 400 mg/kg (2 dosings) and 600 mg/ml (1 dosing) in both sexes. From these results, a single administration of 200, 400, and 600 mg/kg was chosen for the males and a single administration of 100, 200, and 400 mg/kg was chosen for the females in the micronucleus assay.

No significant increase in the numbers of micronuclei relative to the concurrent solvent controls was seen in the male animals (200, 400, and 600 mg/kg) or female animals (100, 200, and 400 mg/kg) at sacrifice times of 24, 48, or 72 hours after dosing.

It was therefore concluded that Ordram Technical was non-clastogenic under conditions of this test.
(J.B. Majeska, Stauffer Chemical Co., T-11620, Nov.1983)

8. ECOTOXICOLOGICAL STUDIES

8.1. Toxicity to Avian Wildlife

8.1.1 Subacute Toxicity in Mallard Ducks

Groups of 10 Mallard ducklings were administered for 5 days a diet containing 0.1, 0.18, 0.32, 0.56, 1.0, 1.8 and 3.2% Ordram and then returned to untreated diet for 3 days. The 5-day dietary LC 50 in this study was 13000 ppm (= 1.3%). The no-effect level in this study was 1000 ppm (0.1%) Ordram.
(Woodard Research Corporation, August 1965).

8.1.2 2-Months Subacute Feeding of Ordram in Coturnix Quail

Technical Ordram was fed in the diet to groups of 10 Coturnix quails at levels of 10, 100 and 1000 ppm for nine weeks. Behavior, body weight, fertility, egg hatchability, relative and absolute organ weights at the 10 ppm group was comparable to controls. Higher dietary levels induced reduced hatchability, feed intake and body weights. 10 ppm was the NOEL in this study.

8.2 Review of the Acute and Subacute Toxicity and Bioaccumulation of ORDRAM in Fish and Aquatic Invertebrates

Summary

Acute LC_{50} values obtained from static aquatic toxicity tests of up to 96 hr duration indicated that Ordram is slightly toxic to several species of warm water fish (13-43 ppm), and moderately toxic to rainbow trout (0.2-7.0 ppm). The 48hr LC_{50} values for Ordram in several species of warm-and cold-water invertebrates varied from 0.2 to 385 ppm. Common carp were exposed to Ordram, Machete or Saturn (Bolero) for 21 days at a range of exposure concentrations. Ordram at 2 ppm produced no effects in carp and was less toxic than either Saturn or Machete. Channel catfish exposed to Ordram 6E formulation for 11 days showed no effects at levels as high as 3 ppm (a.i.). In carp, Ordram is rapidly metabolized to polar metabolites. Bioaccumulation studies with catfish and bluegill indicated that Ordram is concentrated to only a small extent and that these low tissue residues rapidly declined when the exposure was withdrawn. These data are consistent with the conclusion that Ordram presents minimal hazard to the aquatic environment.

Acute Toxicity of Ordram to Freshwater Fish

The acute toxicity of Ordram to several species of freshwater fish was determined using the static test procedure. Briefly, Ordram neat, or diluted in organic solvent, was mixed into aerated water and the fish were placed in the test media (water plus test chemical). No additional test material was added nor was the test media aerated during the 4 day (96 hr) test. The acute LC_{50} values were calculated from the mortality data after 24, 48 and 96 hrs using one of several different statistical methods. To facilitate comparison, LC_{50} values were recalculated by this reviewer using a standard method (21). However, in many studies, the mortality observed after 24 or 48 hrs was insufficient to permit calculation of LC_{50} values.

The data for the acute aquatic toxicity of Ordram to several species of freshwater fish are summarized in Table 1. The 96 hr LC_{50} values for warm-water fish including carp, goldfish, bluegill sunfish, mosquito fish, fathead minnow, and catfish ranged from 5 to 43 ppm. Where more than one test was performed on a particular species, the results were usually consistent and LC_{50} values varied only by a factor of 2 or 3. In acute studies conducted by Brown et al (6), catfish were treated with Ordram in tap water and in two samples of water from rice paddies. The 96 hr LC_{50} values for Ordram in tap water and in two samples of paddy water were quite similar (33 and 29 ppm, respectively, see Table 1). However, a much lower LC_{50} (5 ppm) was obtained for Ordram in a third sample of paddy water. Since only 75% of the controls survived in the latter study the authors suggest that an unknown toxicant was probably present in the paddy water.

For rainbow trout, a cold-water species, the 96 hr LC_{50} values varied from 0.2 to 7 ppm and were lower than the LC_{50} values obtained for any of the warm-water species. The 0.2 ppm value obtained by a USDI Laboratory (8) was several fold lower than values obtained in the other two tests in this species (1.3 ppm and 7 ppm). Since the description of the test system used in the USDI study was incomplete, no comparison of test methods can be made to resolve the apparent inconsistency.

In acute tests with fish, signs of toxicity were similar for all the species tested. After 1 or 2 days of exposure to Ordram at the very high toxic doses, the skin coloration became darker and the fish tended to inhabit the upper layers of water and surface often. The fish exhibited hyperactivity, erratic swimming behavior and had labored respiration (exaggerated gill movements). Progressively, the fish lost their ability to swim upright and sank to the bottom and died. Most deaths occurred between day 2 and 3.

Acute Toxicity to Freshwater Invertebrates

The available information on acute toxicity of Ordram to several species of freshwater invertebrates is summarized in Table 2. Most of the data are derived from the scientific literature. Studies were performed under static conditions using an exposure system similar to that described for acute fish tests. Unfortunately, many important details of the test conditions were not provided in the literature reports and for many tests, 96 hr LC_{50} values were not reported.

For aquatic invertebrates, the 48 hr LC_{50} values ranged widely from 0.6 to 325 ppm. As shown in Table 2, many apparent inconsistencies in LC_{50} values are evident within a particular species. For example, the reported 48 hr LC_{50} values varied several fold for water flea (32 fold), grass shrimp (20 fold), and one species of crayfish (4 fold). Also, marked differences in 48 hr LC_{50} values are evident between genus and species of Scud (a freshwater crustacean) and crayfish. As with the acute fish studies, the description of the test system was often incomplete, which precluded determination of the reason for the unexpected variability observed in these studies. However, it is clear from the information available that the toxicity of Ordram to aquatic invertebrates is not remarkable.

Similar toxic signs were described for the 8 species of aquatic invertebrates (excluding clam). In general, test organisms exhibited hyperactivity and/or hyperexcitability immediately after addition of the test material which persisted for a few to several hours. Thereafter, markedly reduced activity was noted throughout the test period. As observed in the fish tests, death was usually delayed 1 to 3 days after exporsure.

Subchronic Toxicity of Ordram to Freshwater Fish

Common carp (232 mm, 210 g) were exposed for 21 days in a static test to a range of concentrations (nominal) of Ordram Tech. (0.01, 0.05, 0.1, 0.5, 2.0, 5.0, 10.0 and 15 ppm), the Ordram formulation Mamet SM (0.75, 1.5, 3.0, 7.5, 15.0, 30.0 and 60 ppm), Byram Tech. (0.05, 0.5 and 2 ppm), Saturn Tech. (0.5, 2.0, 5.0, 10.0, and 15.0 ppm), Saturn S (15, 30, and 60 ppm), Saturn SM (15, 30 and 60 ppm) and Machete (0.05, 0.5 and 2.0 ppm). Carp (thirty per dose group) were maintained in 500 liter tanks with sufficient aeration to maintain adequate O_2 levels (>5.5 mg/l). Biological loading was 30 g/l and carp were fed once per day during the test. On days 0, 3, 7, 10, 14 and 21, hematocrit (HCT), hemoglobin (HG), erythrocytes (RBC) and white blood cells (WBC) were measured in carp and ammonia was measured in the water.

Ordram Tech. at concentrations of $\leq$ 2 ppm produced no mortality or toxic signs. Carp exposed to 5 ppm of Ordram or more exhibited a dose-related incidence of toxic signs and mortality. At 5 ppm of Ordram Tech., carp exhibited no mortality but were observed to be dark in color and lethargic throughout the test. Carp exposed to 10 or 15 ppm of Ordram Tech. exhibited hyperactivity and after several days were observed to have areas of apparent hemorrhage on their ventral surface. At the highest exposure levels (10 and 15 ppm), mortality was observed beginning on day 4 and all carp died by day 11. Except for an increase in WBC count at the highest dose, no significant changes in ammonia production, RBC count, HCT or HG were noted. Ordram granular formulation (Mamet SM), at the highest concentration tested (60 ppm of product, 4.8 ppm a.i.), produced decreased HCT and RBC values but no mortality or toxic effects were noted at any of the lower concentrations tested.

Exposure to Byram Tech. at 2, 0.5 and 0.05 ppm for 21 days produced no significant adverse effects on behavior or survival of carp.

Carp exposed to Saturn Tech. at $\leq$ 2 ppm did not exhibit any mortality or toxic signs. However, carp exposed to 10 and 15 ppm of Saturn Tech became dark almost immediately upon initiation of exposure and all carp in both of these treatments died within 24 hours. Carp exposed to the Saturn granular formulations, Saturn S and Saturn SM, at concentrations ≥ 15 ppm of product (1.05 ppm and 1.5 ppm a.i., respectively), experienced significant mortality and dose-related toxic signs. The toxic signs included darkening of the body, exopthalmos, lethargy, hemorrhagic patches, and decreased RBC and/or WBC counts.

Machete Tech. at ≥ 0.5 ppm produced a dose-related incidence of mortality and toxic signs (darkening of the skin, lethargy and apparent loss of equilibrium). At 0.5 ppm, mortality was observed beginning on day 11 of exposure and all carp had died by day 14. At 2 ppm, carp became dark in color and lethargic shortly after exposure, a loss of equilibrium was evident by day 1, and all carp died by day 4. The carp that died after exposure to Machete had evidence of massive internal hemorrhage at necropsy.

Bioaccumulation Studies

Bluegill sunfish were continuously exposed in a dynamic test system to a nominal concentration of 1.0 or 0.01 mg/l ^{14}C-Ordram for 35 days, after which the remaining fish were transferred to flowing uncontaminated water for 14 days (15). Radiometric analyses of water and fish tissues were performed in intervals during both exposure and withdrawal. Mean measured concentration of ^{14}C-residues in water during the 35-day exposure period was 1.04 ppm for the high level and 0.012 ppm for the low level. No mortality was observed in either dose group. Throughout the test, fish in both treatment levels fed readily and behaved normally. Equilibrium concentrations of accumulated ^{14}C-residue in the edible portion were obtained in both treatment groups during the 35 day exposure period and were approximately 12 times (x) and 16.4X the concentration of Ordram in water, respectively. Fish exposed to 1.04 ppm ^{14}C-Ordram for 35 days had 4.5X more ^{14}C-residue in the non-edible portion than in the edible portion. The corresponding value for fish exposed to 0.012 ppm ^{14}C-Ordram was 10.2X. Those fish placed in uncontaminated flowing water eliminated 57% and 54% of those ^{14}C-residues present after 35 day exposure for the high and low level, respectively, within 24 hours.

Juvenile channel catfish (Ictalurus punctatus) were continuously exposed in a dynamic test system to nominal concentrations of Ordram 6E equivalent to 0.12, 0.60 and 3.0 ppm of pure Ordram for 11 days, after which the remaining fish were transferred to flowing, uncontaminated water for 7 days (16). Gas-liquid chromatographic analyses of water and fish tissues were performed at intervals during both exposure and withdrawal. Mean concentrations of Ordram measured in the water during the 11-day exposure period were 0.13, 0.62 and 3.17 ppm for the low, intermediate and high levels, respectively. No mortality was observed at any concentration. Based on maximum Ordram concentrations detected in the carcass after 11 days of exposure, concentration factors for the 0.13, 0.62 and 3.17 ppm concentrations were 9.3X, 6.5X and 10.8X, respectively. Those fish placed in clean flowing water metabolized and/or eliminated more than 90% of the Ordram residue present in the carcass within 24 hours. Throughout the study period, the fish appeared normal, fed readily and appeared to be in excellent physical condition.

Field Studies

A cooperative study was conducted by the California Central Valley Regional Water Quality Control Board (24) and the California Department of Fish and Game (25) to assess the toxic effects of commonly used rice pesticides under actual field conditions. Juvenile channel catfish (Ictalurus punctatus) were housed in wire mesh cages placed in drainage water from rice fields. Ordram residues were measured in water samples taken from fields and drains. Mortality, packed cell volume, total plasma protein and brain acetylcholinesterase were measured in the fish. The fields were treated with Ordram 10G at recommended application rates (4-5 lbs a.i. per acre). In addition, methyl parathion and MCPA were also applied to some of the fields during the study. In fields where flood water was held for 6-7 days after application, as is the recommended practice, Ordram residues had declined to approximately 0.2 ppm when the water was released into drains. Where the irrigation water was not held, Ordram concentrations in drain water reached 0.6 ppm immediately after application (24). Ordram residues in fish placed in drains where water was not held were approximately three fold higher (2.1-4.9 ppm) than those in fish from water that was held before release (0.6-1.4 ppm). A significant drop in blood plasma proteins occurred in the fish from the former treatment, but not from the latter. No mortality was seen in any of the fish tested, nor were any effects on acetylcholinesterase or packed cell volume noted.

Metabolism of Ordram in Carp

The metabolic fate of Ordram was investigated in Japanese Carp (*Cyprinus carpio*) variety Yamato Kai (17). [Ring-^{14}C] Ordram was applied to water at 0.2 ppm in a static system. The overall ^{14}C residue in tissues of fish were low. A maximum concentration factor in the edible portion (muscle tissue) of 1.15 was attained during the 14 day study. Ordram disappeared rapidly from the water containing the carp. It accounted for only 3.8% of the extracted radiocarbon present in the water 14 days after treatment. Ordram was converted into various organo-soluble and water-soluble degradation products shortly after addition to the water. Polar metabolites, but no unchanged Ordram, were found in the bile. These data show that major metabolic pathways for Ordram in carp involve sulfoxidation and oxidation to both hydroxy and keto derivatives. A later study showed that Ordram mercapturate was a major metabolite recovered from the bile of Ordram treated carp (18).

Discussion

In acute toxicity tests under static conditions, Ordram had rather low toxicity to seven (7) species of warm-water fish and moderate toxicity to rainbow trout, a cold-water species. Where more than one test was performed on a species, the results were usually consistent. In similar acute static tests with six (6) species of aquatic invertebrates, LC_{50} values were variable, ranging from 0.2-385 ppm.

Considerable intra-and inter-species variability was evident in the toxicity of Ordram to aquatic invertebrates. After exposure to toxic doses of Ordram, both fish and invertebrates exhibited hyperexcitibility and/or hyperactivity followed by reduced activity. Death was usually delayed 1-3 days after exposure.

Subchronic exposure of common carp to Ordram technical or granular formulations under static conditions produced no dose-related mortality or incidence of toxic signs at concentrations of $\leq$ 2 ppm (a.i.). Effects on blood parameters (elevated white blood cell count and/or decreased hematocrit and red blood cell counts) and red discolored areas on the skin (suggestive of hemorrhage) were observed at Ordram concentrations of $\geq$ 5 ppm (a.i.). Under the same test conditions, the competitive products Saturn (technical and granular formulations) and Machete technical were much more toxic to carp than Ordram as evidenced by higher mortality, and the faster onset and greater severity of toxic signs. Exposure of channel catfish to concentrations of Ordram-6E formulation as high as 3 ppm (a.i.) for 11 days resulted in no adverse effects during the exposure period or the following 7 day observation period.

In a 35 day dynamic test with bluegill, equilibrium bioconcentration (BC) values of 10 to 16 were obtained after 35 days of exposure. More than 4.5 times as much Ordram was detected in the nonedible portion (viscera) as in the edible portion (muscle). In an 11 day dynamic study with catfish, the BC values measured (6.5-10.8) were only slightly lower than those obtained in the longer term study. In both studies, most of the Ordram residue in the fish (54-90%) was eliminated within 24 hours after the fish were placed in flowing uncontaminated water. In carp, Ordram is rapidly and extensively metabolized to more polar products and rapidly excreted (17, 18).

Recent reports in the scientific literature support the conclusion that Ordram is eliminated rapidly from tissues of fish once exposure is withdrawn. In comparing the overall bioaccumulation potential of several major categories of pollutants, Barrows et al (22) showed that when bioconcentration factors were low (≤ 1000) the equilibrium time and the biological half-lives were short (≤ 7 days). Barrows et al indicate that these compounds would not be concentrated or retained to any great degree by aquatic organisms. Macek et al (23) studied the bioaccumulation of over 50 pesticides and concluded that, in general, the rate of bioaccumulation of those materials into bluegill tissues is inversely correlated with water solubility. Thus, tissue residues for pesticides such as Ordram with relatively high solubility (800 ppm at 20°C), would be expected to be small and short-lived, provided the source of contamination is not continuous or the duration of exposure prolonged.

Environmental monitoring and field toxicity studies conducted by the State of California support the results of Stauffer sponsored fish subchronic toxicity tests. The environmental monitoring studies indicate that when Ordram is used as recommended, the Ordram residues in drain water are very low (24). The field toxicity studies showed that the small Ordram residues in fish did not produce mortality under actual exposure conditions (25). Bioaccumulation and metabolism studies reported herein clearly show that under both static (19) and dynamic conditions (15, 16), Ordram is concentrated to only a small extent in tissues of fish. Furthermore, these low tissue residues are eliminated rapidly when the exposure is withdrawn (17, 18, 22, 23).

The available aquatic toxicology information is consistent with the conclusion that Ordram presents a minimal hazard to the aquatic environment.

Written by: Jeff Miller 6/18/81
J. L. Miller, Ph.D.
Environmental Toxicologist

REFERENCES

1. The Acute Toxicity of Ordram Technical to the Carp (Cyprinus Carpio). Union Carbide Environmental Services. Report No. 4506-22-09. April 19, 1978. (T-6414)

2. Ordram: Safety Evaluation on Fish and Wildlife (Mallard Ducks, Rainbow Trout, Sunfish, Goldfish). Woodard Research Corporation. August 2, 1965. (T-2009)

3. The Acute Toxicity of Ordram to Bluegill (Lepomis macrochirus), Rainbow Trout (Salmo gairdneri), and Fathead Minnow (Pimephales promelas). Bionomics, Inc., July, 1970. (T-2235)

4. Letter. To: Frank Mingledorff (Water Enforcement Branch) From: William H. Peltier (Ecology Branch) United States Environmental Protection Agency. Region IV, Surveillance and Analysis Division. College Station Rd., Athens, Georgia. Dated May 13, 1977.

5. The Acute Toxicity of Ordram to Common Catfish (Ictalurus punctatus). Stauffer Chemical Company Toxicology Laboratory Report T-4028, August 18, 1972.

6. Brown, K. W., D. C. Anderson, S. G. Jones, L. E. Deuel and J. D. Price. The Relative Toxicity of Four Pesticides in Tap Water and Water From Flooded Rice Paddies. Intern. J. Environ. Studies. 14:49-54, 1979.

7. Thiocarbamate Herbicide Mosquito Fish Bioassay. Stauffer Chemical Co. Toxicology Summary T-1272. December 9, 1968.

8. Chaiyarach, S., V. Ratananun and R. C. Harrel. Acute Toxicity of the Insecticide Toxaphene and Carbaryl and the Herbicides Propanil and Molinate to Four Species of Aquatic Organisms. Bull. Environ. Contamin. Toxicol. 14:281-284, 1975.

9. Toxicity of Ordram 6E (R-4572 6E) to Stickleback. Stauffer Chemical Co. Fish Toxicity Assay Report No. 244. March 4, 1963.

10. Saunders, H. O. Toxicities of Some Herbicides to Six Species of Freshwater Crustaceans. J. Water Poll. Cont. Fed. Part I, 1544-1550, August, 1970. (T-221

11. Saunders, H. O. Toxicity of Pesticides to the Crustacean Gammarus lacustris. United States Department of the Interior. Fish and Wildlife Service. Technical Paper #35. 1969, 18p. (T-2214)

12. Cheah, M. L., J. W. Avault and J. B. Graves. Some Effects of Thirteen Rice Pesticides on Crawfish. Procambarus clarkii and P. acutus acutus. Presentatio at 4th International Symposium of International Association of Astacology. Tho les Bains, France, August 28-31, 1978.

13. Graves, J. Louisiana State University, Personal Communication, March 7, 1972.

14. Cope, O. B., Chief, Fish-Pesticides Research Lab. U.S.D.I., Bureau of Sport Fisheries and Wildlife, Denver, Co. Letter dated 10/20/64.

15. Exposure of the Bluegill Sunfish (Lepomis macrochirus) to ^{14}C-Ordram - Accumulation, Distribution and Elimination of ^{14}C-residue. Bionomics, Inc., September, 1973. (T-2055)

16. Continuous exposure of Channel Catfish (Ictalurus punctatus) to Ordram© in Water. Bionomics, Inc. May, 1971.

17. Lay, M. M., A. M. Niland, J. R. DeBauh and J. J. Menn. Metabolism of Thiocarbamate Herbicide Molinate (Ordram) in Japanese Carp. ACS Symposium Series No. 99 pp. 95-119, 1979.

18. M. M. Lay and J. J. Menn. Mercapturic acid Occurrence in Fish Bile. A Terminal Product of Metabolism of the Herbicide Molinate. Xenobiotica 9:11, 669-673, 1979.

19. Bentley, R. E., and K. J. Macek. Some Effects of Exposure to Herbicides on Behavior, Survival and Selected Physiological Parameters of Carp (Cyprinus carpio). An EG&G Bionomics Research Report Submitted to Stauffer Chemical Co. March, 1976. (T-2288)

20. The Acute Toxicity of Ordram Technical to the Water Flea, Daphnia Magna Straus. Union Carbide Environmental Services Report Dated October 3, 1977. (T-6374).

21. Litchfield, J. T. and F. Wilcoxon. A Simplified Method of Evaluating Dose-Effect Experiments. J. Pharmacol. Exper. Therap. 96:99-113 (1949).

22. Barrows, M. E., S. R. Petrocelli, K. J. Macek, and J. J. Carol. Bioconcentration and Elimination of Selected Water Pollutants by Bluegill Sunfish (Lepomis macrochirus). In: Dynamics, Exposure and Hazard Assessment of Toxic Chemicals. R. Hague (ed.). Ann Arbor Science Pub., Inc., Ann Arbor, MI (1980).

23. Macek, K. J., M. E. Barrows, R. F. Frasny, and B. H. Sleight, III. 1975. Bioconcentration of 14 C-Pesticides by Bluegill Sunfish During Continuous Exposure. pp. 119-142 in G. D. Veith and D. E. Konasewich, eds. Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms. Proceedings of a Symposium, Burlington, Ontario, March 11-13, 1975. Sponsored by Standing Committee on Scientific Basis for Water Quality Criteria of the International Joint Commission's Research Advisory Board.

24. Van De Pol, R. M. and F. H. Plescia. Levels of Agricultural Chemicals in Irrigation Return Flows From Rice Fields in Sacramento and Sutter Counties, California. California Regional Water Quality Control Board, Central Valley Region, 1978.

25. Curtis, T. C. and B. Lee. Effect of Parathion and Ordram Contaminated Agricultural Field Drainage on Packed Cell Volume, Total Plasma Proteins, and Brain Cholinesterase in Channel Catfish. California Department of Fish and Game, Pesticide Project, 1978.

3 10 00378

TABLE 1

ACUTE TOXICITY OF ORDRAM TO FRESHWATER FISH

Test Organism (Genus Species)	LC50, ppm[a] 95% Confidence Limits 24 hr	48 hr	96 hr	Purity of Ordram (% a.i.)	Fish Size (weight and length)	pH	Temp. (°C)	Biological Loading	Solvent Added (amount)	Reference
Carp, Common *Cyprinus carpio Linnaeus*	51 (42-51)	43	43	Tech 98.9%	4.8g 7cm	7.3	22 ± 0.5	1.6	Acetone (-)	1
Goldfish *Carassius auratus*		>32	30 (16-56)	Tech 97.8%	1.5g 3.5cm		16 - 19	0.5	Acetone (-)	2
Bluegill Sunfish *Lepomis macrochirus*	>37		19 (17-21)	Analytical 99%	1.5g 4.3cm	7.1	18 ± 0.5			3
		37 (23-60)	29 (20-40	Tech 97.8%	1.5g 3.6cm		16 - 19	0.5	Acetone (-)	2
			33.1		0.9g 4.1cm					4
Catfish, common *Ictalurus punctatus*			13 (11-16)		3.8 - 5.1g 1.5cm	7	16 - 17	3.3	None	5
	33 (33-35)	33 (32-35)	33[b] (32-35)		0.3g	8.5	23 ± 2		Acetone 3ml	6
	34 (28.4 - 45.5)	15.7 (13.3 - 18.1)	5.0[c] (-)		0.3g	6.4	23 ± 2		Acetone 3ml	6
	41	35.5 (24.4 - 59.2)	29.4[d] (19.7 - 45.4)		0.3	6.4	23 ± 2		Acetone 3ml	6
Fathead minnow *Pimephales promelas*	>42		25 (20.5 - 33)	Tech 95%	0.8g 4.2cm	7.1	18 ± 0.5			3
Mosquito Fish *Gambusia affinis*			26	Ordram 6E Formulation	1.5 - 4.5cm		20-22°C			7
	30.7	21.4	16.4	Ordram 6E Formulation	3 - 4 cm					8
Stickleback *Gasterosteus aculeatus*			19[e]	Ordram 6E Formulation						9
Rainbow Trout *Salmo gairdneri*		>28	7.0 (5.2-9.3)	Tech 99%	1.5g 4.9cm	7.1	13 ± 0.5			3
		1.8 (1.9-3.5)	1.3 (0.9-1.9)	Tech 97.8%	1.2g 4.4cm	-		0.4	Acetone (-)	2
	0.5	0.3	0.2							14

[a] LC50 was calculated by the method of Litchfield and Wilcoxin (1948) unless otherwise indicated.

[b] Toxicity determined in tap water.

[c] Toxicity determined in rice paddy water I, see reference for details.

[d] Toxicity determined in rice paddy water II, see reference for details.

[e] LC50 calculated according to Gaddum et al, Br. J. Pharmacol. and Chemotherapy 11:2, 156-60, 1956.

ACUTE TOXIC[illegible] OF ORDRAM [illegible]O A[illegible]C INVERTEBRATES

Test Organism (Genus Species)	LC50,(TL50), [a]ppm 95% Confidence Limits 24 hr	48 hr	96 hr	Purity of Ordram	Test Organism Size	Temp. (°C)	pH	Reference
Water flea *Daphnia Magna*		0.6 19.4		Tech. Tech	EI[b] EI	21 17	7.4 7.6	10 20
Seed Shrimp *Cypridopsis Vidna*		0.18		Tech.	EI	21	7.4	10
Scud *Cammarus fasciatus*		0.39		Tech.	EI	15.5	7.4	10
	0.6 (0.3-0.9)	0.4 (0.2-0.6)	0.3 (0.1-0.7)	Tech.		15.5	7.4	10
Gammarus lacustris	9.8 (6.9-1.5)	7.6 (6.1-9.5)	4.5 (3.5-5.8)	Tech	2 mo. old	22	7.1	11
Grass Shrimp *Palaemonetes*		1.0		Tech	EI	21	7.4	10
Kadiakensu	22	20	15.9	8E	25-31 mm			8
Crayfish *Ocohectes Nails*		5.6		Tech	EI	15.5	7.4	10
Procambarus clarkii		14.0			25-35 mm		8.4	12
		58 (42-80)						13
Procambarus simulans	34.7	33.2	21.8	8E	60-70 mm			8
Mactrid Clam *Rungia cyneata*	750	385	197	8E				8

[a] The criterion employed for death was failure to move when appendages and/or antennea were stimulated. The LC50 [illegible]ues were calculated by the method of Litchfield [illegible] Wilcoxin (1948).

3 10 00379

9. REFERENCES

De Baun, J.R., Bova, P.L., Finley, K.A. and Menn, J.J: Metabolism of (ring- ^{14}C)-Ordram (Molinate) in the Rat.
1. Balance and Tissue Residue Study, J. Agric. Food Chem., 26, 1096 - 1095, 1975.

De Baun, J.R., Bova, D.L., Tseng, C.K. and Menn, J.J.: Metabolism of (ring- ^{14}C)-Ordram (Molinate) in the Rat.
2. Urinary Metabolite Identification, J. Agric, Food Chem.,26, 1095 - 1104, 1975.

Chubenko, A.P. and Strekosov, B.P. : Migration of Molinate in Rice Paddies in the Kuban River Valley, Khim. Sel. Khoz. 14, (9), 69-72, 1976.

Clive, D., Johnson, K.O., Specter, J.F.S., Batson, A.G. and Brown, M.M.M: Validation and Characterization of the L5178Y TK-/- Mouse Lymphoma Mutagen Assay System, Mut. Res. 59, 61 -105, 1979.

Deuel, L.E., Turner, F.T., Brown, K.W., Price, J.D.: Persistence and Factors Affecting Dissipation of Molinate under Flooded Rice Culture, J. Environ. Qual, 7, 3, 373 - 377, 1978.

Gray, R.A., Soang, S.Y.C. and Weierich, A.J. : Persistence of Ordram in Water in Small Simulated Rice Paddies, Stauffer Chemical, Mt. View Research Center, 1970.

Gray, R.A. and Weierich, A.J. : Leaching of Five Thiocarbamates in Soils, Weed Science, 16, 1, 1968.

Gray, R.A. : Metabolism of Radioactive S-Ethyl Hexahydro-1-H-Azepine-1-Carbothioate in Rice Plants, Stauffer Chemical Co, Mt. View Research Center, 1969.

Imai, Y. and Kawatsuka, S. : Degradation of the Herbicide Molinate in Soils, J. Pestic. Sci. 7, 487-497, 1982.

Lay, M.M., Niland, A.M., De Baun, J.R. and Menn, J. : Metabolism of the Thiocarbamate Herbicide Molinate (Ordram) in Japanese Carp, ACS Sympsium Series, No 99, 95 - 119, 1979.

3 10 00361

Palmer, J.P. : Toxicity of 45 Organic Herbicides to Cattle, Sheep and Chickens, USDA : Production Research Report No 137, 1-40, 1972.

Podlejski, Jaques : Persistence de quatre produits Phytosanitaire dans les Eaux de Rivieres en Camargue; Characterisation de leurs effets sur Ecosysteme, Travaux de la Soc. de Pharmacie de Montpellier, 36, 2, 153-164, 1976.

Podlejski Jaques : Contamination des Eaux de Drainage de Rivière et de leurs Receptables par les Residus de Produits Phytosanitaires en Camargue, Terre Vie. Ecol. Vol 33, 325 - 334, 1979.

Soderquist, C.J., Bowers, J.D., Crosby, D.G. : Dissipation of Molinate in a Rice Field, J. Agric. Food Chem. 25, (4), 940-945, 1983.

Tanji, K.K., Biggar, J.W., Mehran, M., Cheung, M.W., Henderson, D.W., : Herbicide Resistence and Movement Studies with Molinate in Rice Irrigation Managements, Californian Agriculture, May 1974, 10 - 12.

Thomas, V.M., Dennison, J.E., Takahashi, D.C. : Behavior of Ordram in the Environment, Report 2, Stauffer Mt. View Res. Center, MRC-81-01, January 1981.

Thomas, V.M. and Holt, C.L. : The Degradation of ^{14}C-Molinate in Soil under Flooded and Nonflooded Conditions, J. Environ. Sci. Health, B 15, 5, 475 - 484 (1980).

Thomas, V.M. and Holt, C.L. : Behavior or Ordram in the Environment, Rep. No 1, Stauffer Chemical Co., MRC - 78 -07, Sept. 1978.

3 10 00362

APPENDIX XX

DATA SUPPORTING SWAMP AS GROUND-WATER RECHARGE AREA

3 10 00383

11/4/86

The attached data is offered as evidence that the Cold Creek swamp does recharge the groundwater at the Stauffer LeMoyne/Cold Creek Complex and that the groundwater flow is generally to the south. The attached figures are described as follows:

Figure 1 - Shows Cl^- Concentration Trends in Wells #2, #5, #6, & #7 during 1972.

Figure 2 - Shows Cl^- Concentration Trends in Wells #5 & #6 from 1974 until 1978.

Figure 3 - Static Water level elevations with contours for Four Quarters of 1984.

Figure 4 - Hypothetical Representation of Area Groundwater flow after three barrier wells are installed on Stauffer south property line. Contours by Ground Water Associates Inc. in 1978. Covers from Virginia Chemicals to Shell Chemical. Does not include M&T Chemical. Stauffer wells #2, #5, #6, #7 and #10 locations marked.

Figure 5 - Ground Water Associates Water Table Surface Map (1978) showing predicted results of installing three intercept wells on Stauffer south property line. Location of Stauffer wells #2, #5, and #6 are marked.

From Figure 1, it can be determined that Wells #5 and #6 both show strong increasing trends in chloride concentration. Referring to Figure 5, we see that these two wells are located south of the Cold Creek swamp and are down gradient of the swamp.

From Figure 2, we can see a significant decrease in chlorides concentration beginning in early 1976 for both wells #5 and #6. The major reason for this rapid decline in groundwater chloride concentration is that the effluent pipeline to the river was installed at the end of 1975 and plant effluent (high in chlorides) was no longer allowed to flow thru the Cold Creek swamp.

Figure 3 shows the contours of the water table surface through the plant area in 1984 (Quarterly RCRA Data) and is a further proof of groundwater flow to the south.

Figure 4 shows a hypothetical contour of the water table surface (1978) after installation of the three intercept wells. It is a further indication of groundwater flows towards the south. Note that the groundwater south of Courtaulds flows to the north and that Courtaulds has, by far, the largest influence on groundwater flows in the area.

3 10 00384

Based on this information, we can conclude that the groundwater flow at the Cold Creek/LeMoyne complex is generally to the south and that the Cold Creek swamp recharges the aquifer. We may further conclude that the swamp has been washed constantly into the aquifer and by surface flow to the river since the end of 1975 and that all water soluble contaminates have now been removed.

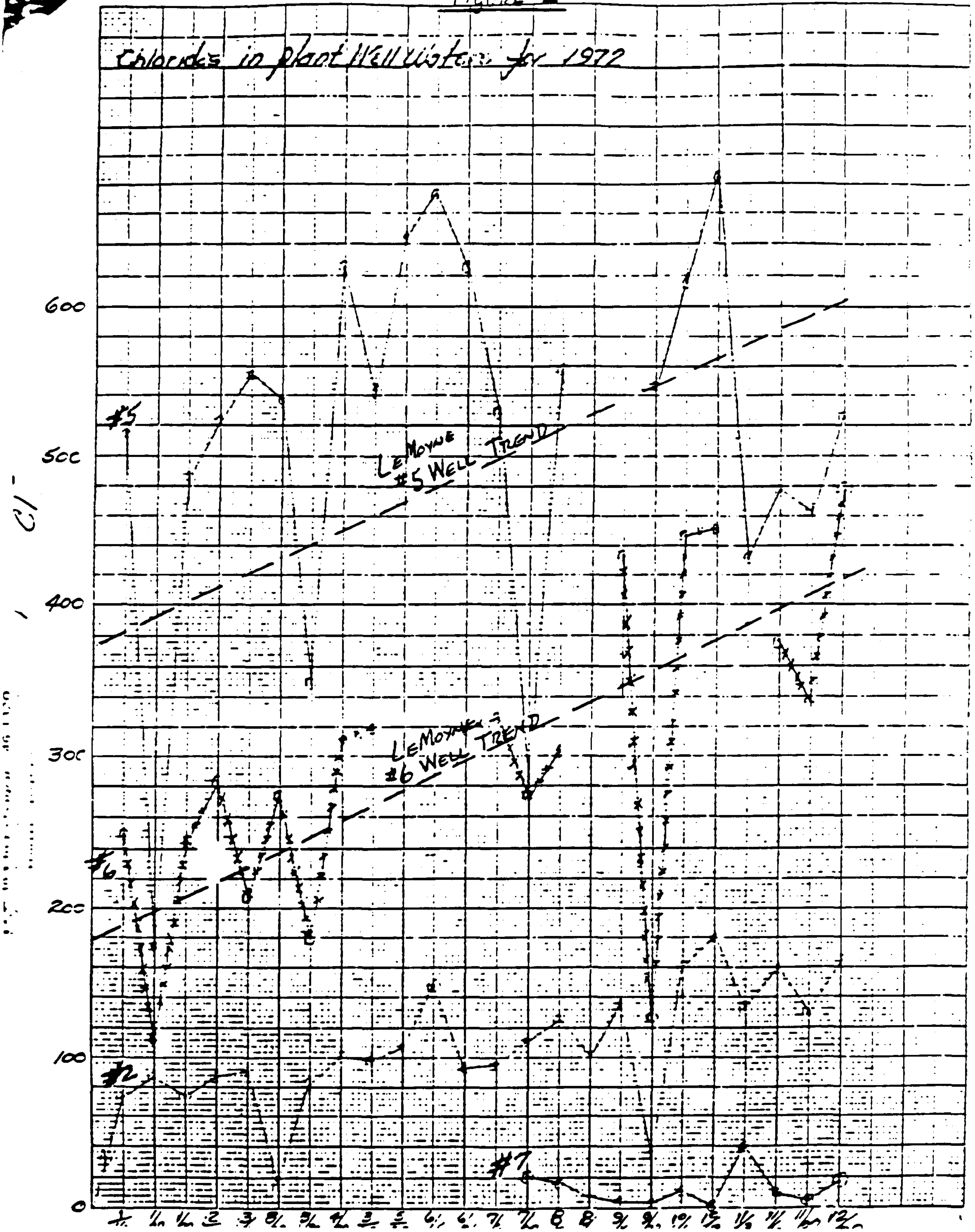
Richard Halstead

Richard Halstead, P.E.

RH:bb

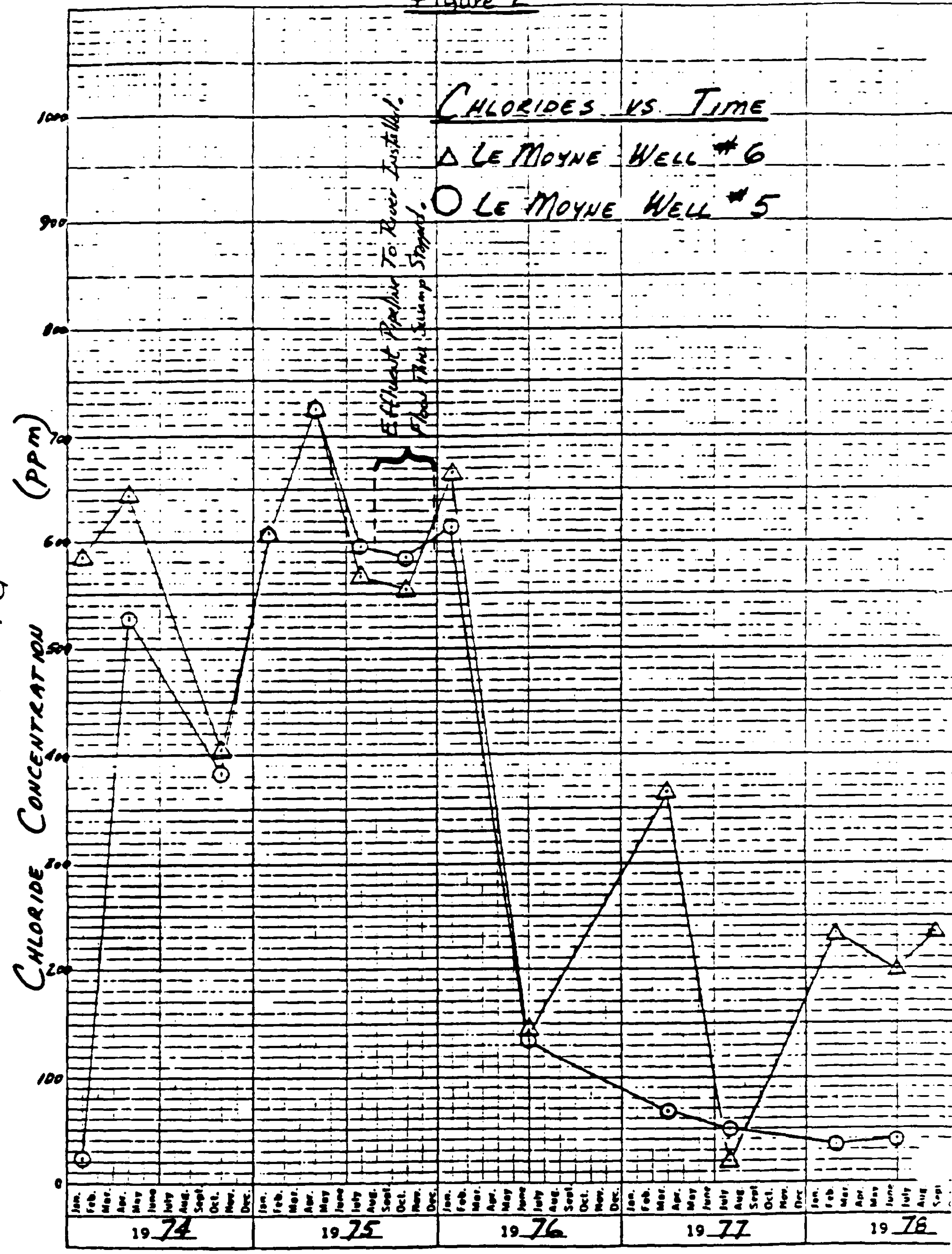
3 10 00365

Figure 1



3-10 00386

Figure 2



K·E 10 YEARS BY MONTHS X 110 DIVISIONS 47 3732 KEUFFEL & ESSER CO.

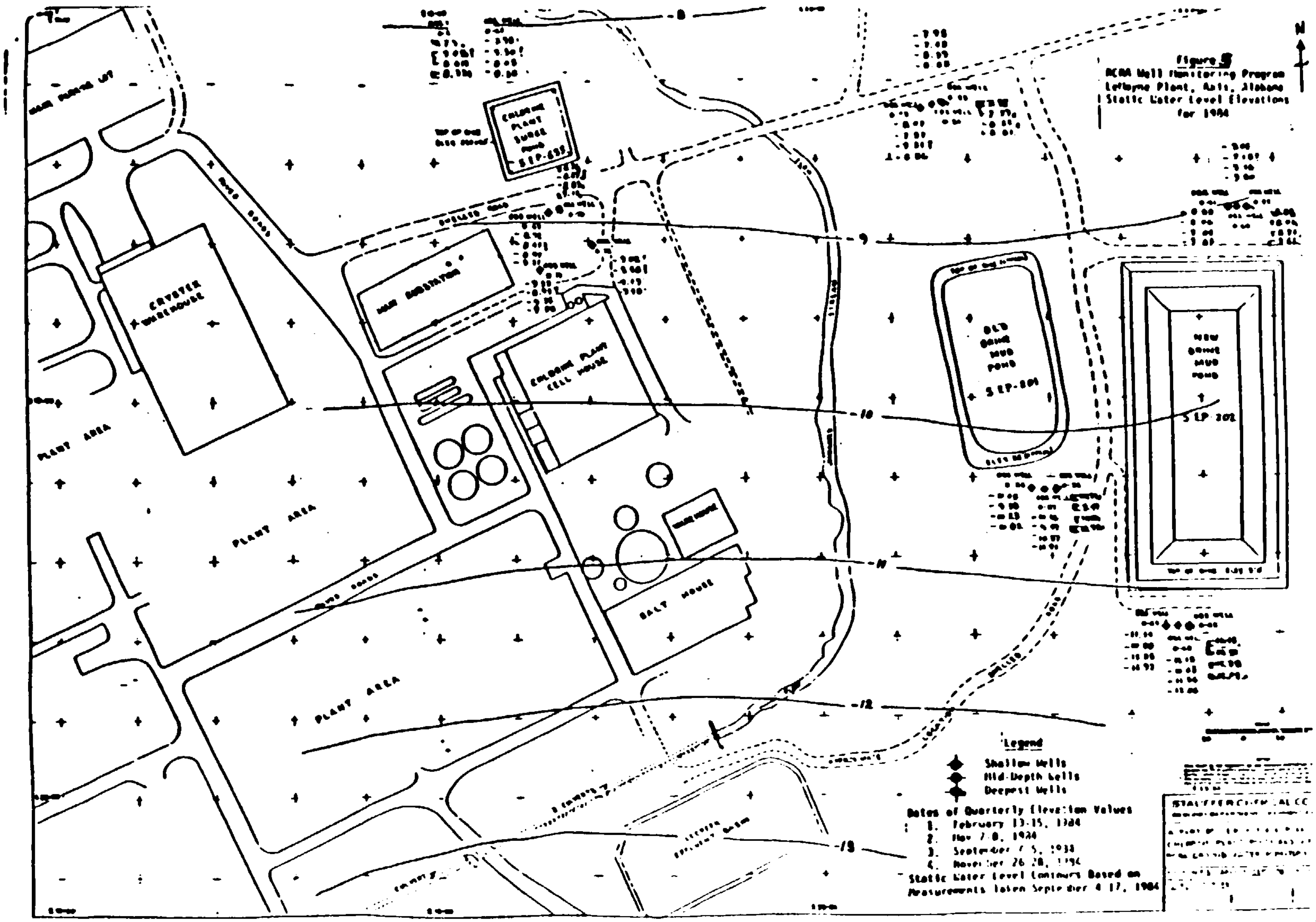


Figure 3

3 10 00387

3 10 00388

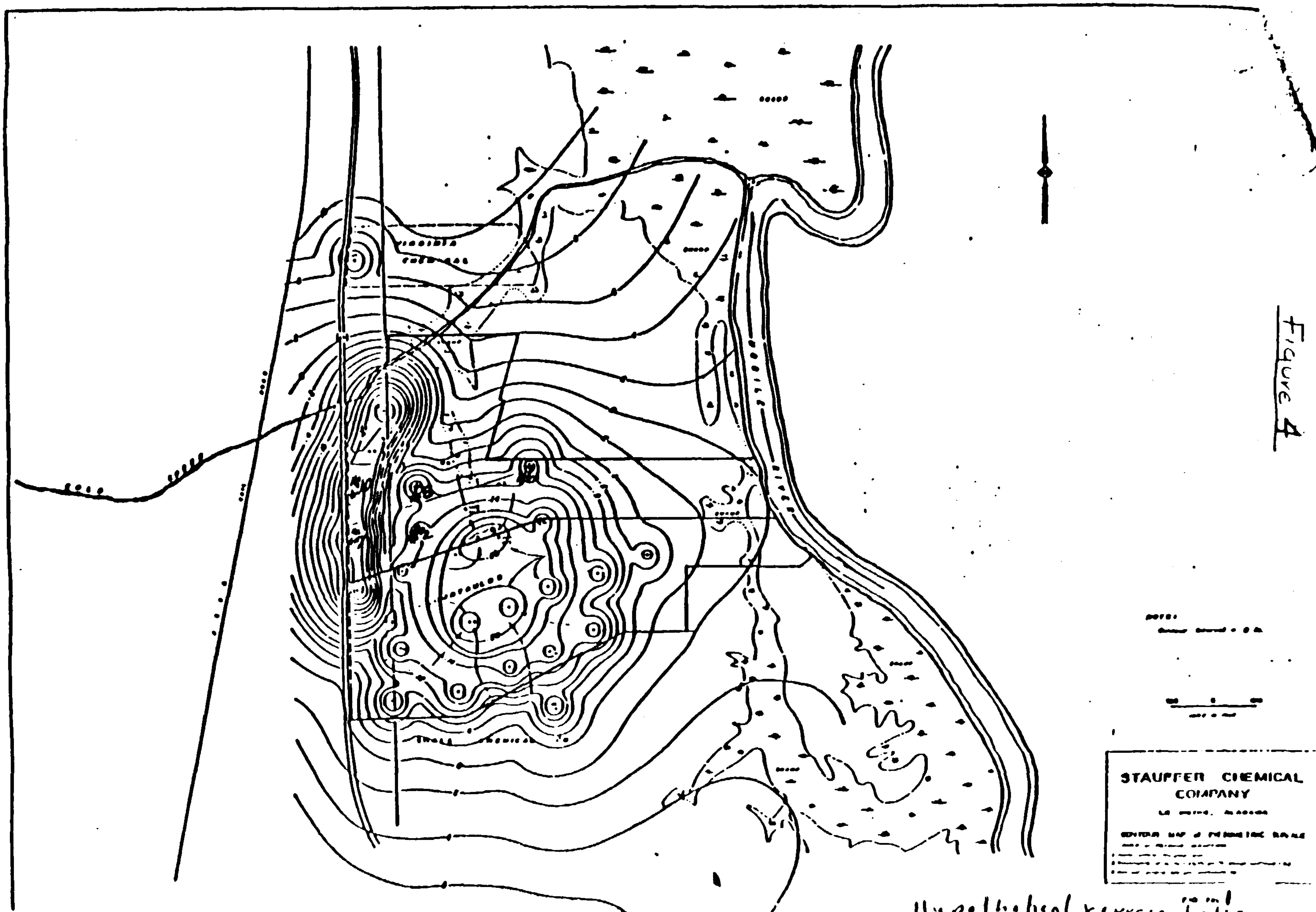
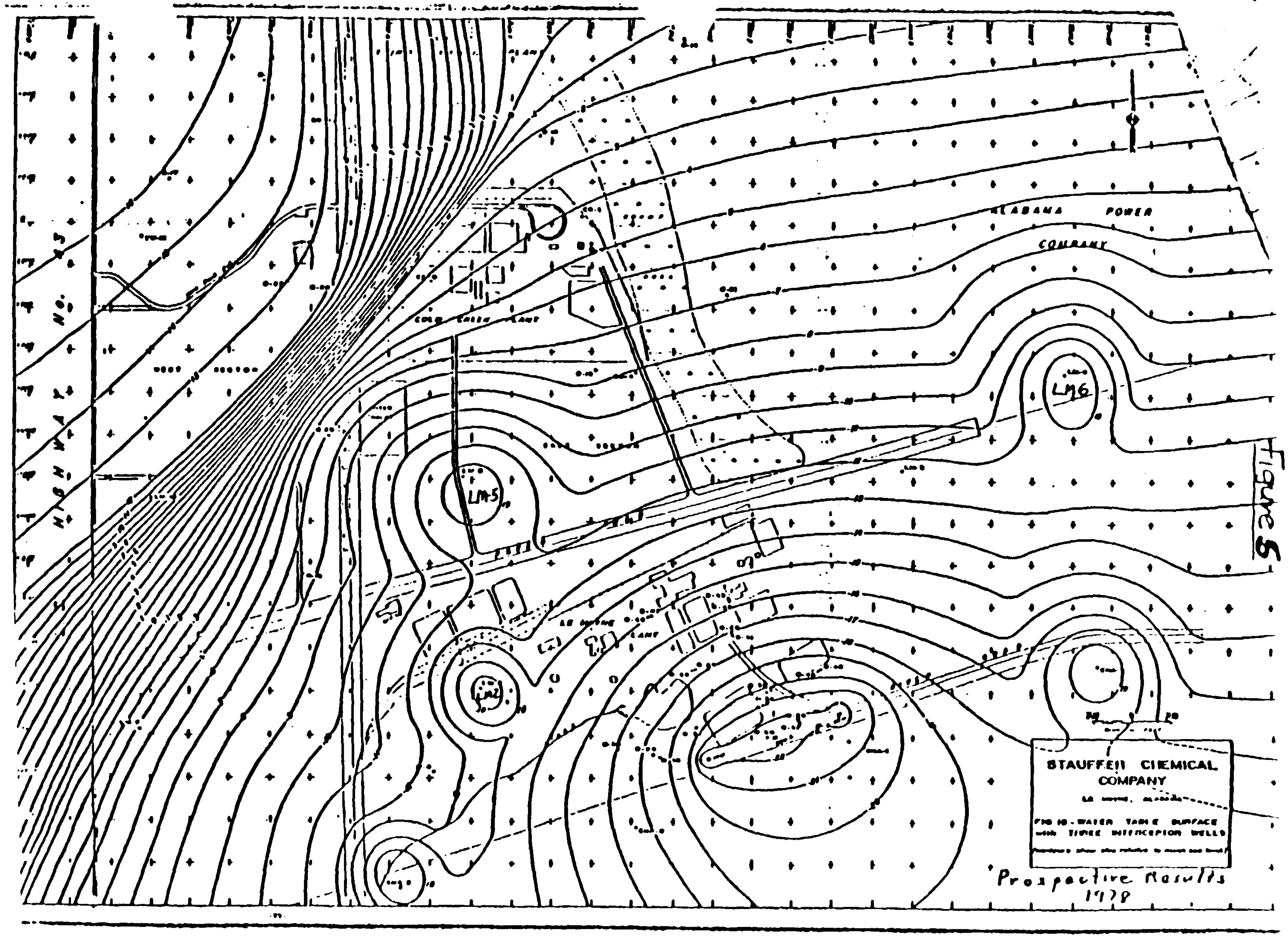


Figure 4

Hypothetical representation



Prospective Results 1978

Figure 5

3 10 00389

~~Figure 8~~

3 10 00390

APPENDIX XXI
IDENTIFICATION OF SAMPLED FISH

TO: R. HALSTEAD

FROM: W. P. STILSON

3 10 00391

OR ITEM No. 10

SUBJECT: BIOLOGICAL (FISH) SAMPLING
REPORT FOR STATE OF ALA.
DEPT. OF CONSERVATION AND NATURAL RESOU
DIVISION OF GAME AND FISH

① DATE OF COLLECTION: THURSDAY AUGUST 7, 1986
TIMES OF COLLECTION: VARIOUS BETWEEN 10:30 AM AND 4:30 PM

② PLACE OF COLLECTION: STAUFFER CHEMICAL CO. PROPERTY AND ADJACENT ALABAMA POWER COMPANY LANDS, NEAR AXIS, ALABAMA (MOBILE COUNTY).
SWAMP ALONG COLD CREEK AND AN UNNAMED TRIBUTARY TO COLD CREEK.

③ SAMPLING PARTY:

GEORGE YOUNG	STAUFFER CHEMICAL CO.
WILLIAM STILSON	STAUFFER CHEMICAL CO.
MIKE NANCE	THOMPSON ENGINEERING & TESTING CO. (WORKING FOR STA
CHARLIE WILSON	CAMP DRESSER & McKEE (CDM) FOR FED. EPA
MALCOME PIERSON	ALABAMA POWER CO.
STEVE KROTZEER	ALABAMA POWER CO.

④ SAMPLING METHOD: BACKPACK ELETRIC SHOCKER UNIT OWNED & OPERATED BY ALABAMA POWER COMPANY. PERSONNEL
FISH SEINE USED AT ONE LOCATION.
MINNOW TRAPS TRIED AT TWO LOCATION WITH VERY LITTLE SUC

⑤ SAMPLE SIZE:

STATION BA-1 — 20 SMALL FISH, (110 GRAMS) 5.5 g/fish, 12 FISH (100 gm) 8.3 = 210 gm

STATION BA-2 — 6 FISH (250 GRAMS) 41.7 PLUS ONE AMERICAN EEL 12" LONG (NOT INCLUDED IN SAMPLE) 250

STATION BA-3 — 7 FISH (100 GRAMS) 14.3, 4 FISH 150 GRAMS 37.5 = 250 GRAMS
STAUFFER SPLIT (½ OF SAMPLE) (ALA. POWER CO. TOOK EQUAL AMOUNT)

STATION BA-4 — 21 VERY SMALL FISH (50 grams) 2.4, 10 FISH (150 grams) 15 = 200
STAUFFER SPLIT (½ OF SAMPLE) (ALA. POWER CO. TOOK EQUAL AMOUNT)

STATION BA-5 — 10 FISH (260 grams) 26 + 1 FISH (300 grams) 300 NOT INCLUDED IN SAMPLE = 260
STAUFFER SPLIT (½ OF SAMPLE) (ALA. POWER CO. TOOK EQUAL AMOUNT)

⑥ DISPOSITION OF SAMPLE: STAUFFER SAMPLES WERE FROZEN AND SHIPPED TO OUR EASTERN RESEARCH L DOBBS FERRY WHERE THE WERE GROUND UP TO POWDER AND KEPT FROZEN.

3 10 00392

State or Country: Alabama Field No. MP86-58
County: Mobile Map:
Locality: Swamp tributary to the Mobile River 3.0 miles SSE of Bucks T1S R1E Sec 1

Township One South, Range one East, section one

Lat. N., Long. W.
Water: Turbid with algae bloom
Vegetation: Pickerel Weed, Panicum, Hairgrass, etc.

Bottom: Deep dark fetid mire; actually silt and organic material
Cover: logs, limbs, stumps etc. Temp: —
Shore: Current: slow - none
Dist. offshore: Stream width:
Depth of capture: To 2 feet Depth of water: To 3 feet
Collected by M. Pierson and S. Krotzer
Tide: Date: 7 August 1986
Method of capture: Backpack Electrofishing
Orig. preserv.: All Fishes frozen for mercury analysis Time: 1030 - 1230

	# of specimens approximate	
1. Amia calva	2	Bowfin
2. Anguilla rostrata (not retained)	1	American Eel
3. Notemigonus crysoleucas	18	Golden shiner
4. Erimyzon sucetta	1	Lake chubsucker
5. Ictalurus natalis	1	Yellow bullhead
6. Fundulus chrysotus	18	Golden topminnow
7. Aphredoderus sayanus	5	Pirate Perch
8. Lepomis gulosus	6	Warmouth
9. Lepomis macrochirus	8	Bluegill
10. Lepomis marginatus	5	Dollar sunfish
11. Lepomis megalotis	6	Longear sunfish
12. Lepomis punctatus	6	Spotted sunfish
13. Micropterus salmoides	6	Largemouth bass
	83	

3 10 00393

State or Country: Alabama Field No. MP86-59
County: Mobile Map:
Locality: Cold Creek 3.1 miles SSW of Bucks downstream of Cold Creek Reservoir. T1S R1W Sec 11
Lat. N., Long. W.
Water: Clear w/ tannin stain
Vegetation: Typha, Panicum

Bottom: silt, sand
Cover: heavy vegetation Temp:
Shore: Current: moderate - slow
Dist. offshore: Stream width: 20 - 30 feet
Depth of capture: To 3 feet Depth of water:
Collected by M. Pierson + S. Krotzer
Tide: Date: 7 August 1986
Method of capture: Backpack Electrofishing
Orig. preserv.: All fishes frozen for mercury analysis Time: 1400-1500

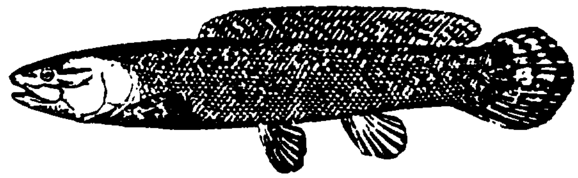
		# of specimens	
1.	Notemigonus crysoleucas	12	Golden shiner
2.	Fundulus olivaceus	2	Blackspotted topminnow
3.	Lepomis gulosus	3	Warmouth
4.	Lepomis macrochirus	10	Bluegill
5.	Lepomis marginatus	4	Dollar sunfish
6.	Lepomis megalotis	6	Longear sunfish
7.	Lepomis microlophus	1	Redear sunfish
8	Lepomis punctatus	3	Spotted sunfish
9.	Micropterus salmoides	1	Largemouth bass
		42	

(No. of specimens estimated)

3 10 00394

Amia calva Linnaeus
Bowfin

Order Amiiformes
Family Amiidae



Female (Jordan and Evermann 1900).

TYPE LOCALITY: Charleston, SC (Linnaeus 1766. *Systema naturae*. Laurentii Salvii, Holmiae. 12 ed., 1:1-532).

SYSTEMATICS: Sole living representative of Amiiformes, which first appeared in Triassic and was well developed in middle Mesozoic (Bailey 1971. McGraw-Hill Encycl. Sci. Technol., 3 ed: 339-40). Genus *Amia* extends back into Upper Cretaceous, and occurs in early Tertiary in North America (Patterson *in* Greenwood et al. (eds.) 1973. *Interrelationships of Fishes*).

See map on next page

DISTRIBUTION AND HABITAT: Known from St. Lawrence and Ottawa rivers and Lake Champlain west throughout Great Lakes, including Georgian Bay and lakes Nipissing and Simcoe, ON; south in Mississippi basin from Lake Winnibigoshish, MN, to LA; in lower TX drainages west to Colorado River; and along Coastal Plain from AL to eastern PA. Changes in environmental quality have probably all but eliminated it from Missouri system, where it was historically known as far north as eastern SD (Churchill and Over 1933. *Fishes of South Dakota*). Pflieger (1975. *Fishes of Missouri*) stated that all Missouri River records may be attributable to introduction, a view not subscribed to here. Introduced in a number of localities in IA, IL, NC, and CT. Inhabitant of sluggish, clear, often vegetated, lowland waters.

ADULT SIZE: 457-610 mm TL, 870 mm TL maximum.

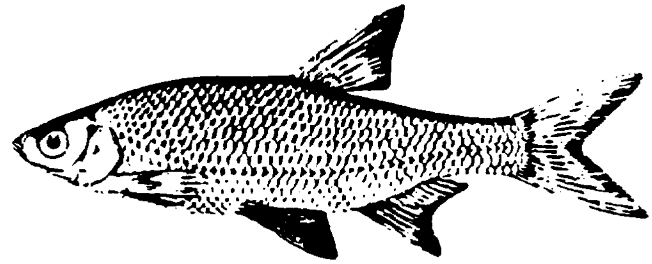
BIOLOGY: Commonly used as laboratory test animal because of status as a "living fossil", ease of maintenance, and interesting behavioral and physiological attributes. Capable of gulping air at the surface and can withstand high temperatures, and is even known to aestivate (Neill 1950. Copeia: 240). Males build circular nests in shallow, vegetated areas in the spring, and protect schooling young after hatching. Mansueti and Hardy (1967. *Development of Fishes of the Chesapeake Bay Region*) described early development. Voracious predator that favors fish but will consume virtually any type of animal. Hoffman (1967. *Parasites of North American Freshwater Fishes*) listed parasites. May live at least 30 years (Carlander 1969. *Handbook of Freshwater Fishery Biology* Vol. 1). Biology summarized in Scott and Crossman (1973. *Freshwater Fishes of Canada*) and Pflieger (1975).

Compilers: G. H. Burgess and C. R. Gilbert.
November 1978.

3 10 00395

Notemigonus crysoleucas (Mitchill)
Golden shiner

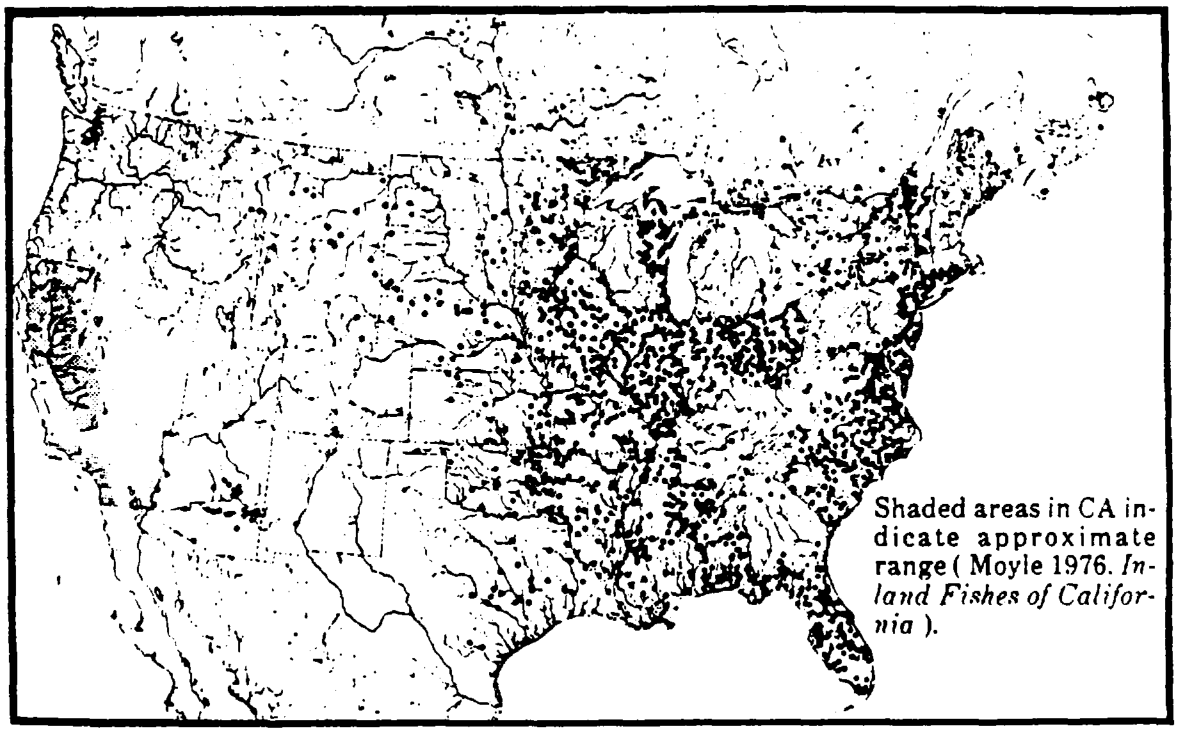
Order Cypriniformes
Family Cyprinidae



MD: Anne Arundel Co., Lake Waterford. 101 mm SL (NCSM).

TYPE LOCALITY: New York (Mitchill 1814. Rept. on Fishes of New York: 1-30).

SYSTEMATICS: Possibly more closely related to certain Eurasian cyprinids than to any North American group (Gosline 1974. Jap. J. Ichthyol. 21: 9-15). Three subspecies have been recognized — *N. c. crysoleucas* in northeast, and *N. c. auratus* and *N. c. bosci* in south — but recent authors have not considered these valid. Variation in anal fin ray count appears to be influenced by water temperature during development (Hubbs 1921. Trans. Ill. State Acad. Sci. 11: 147-51; Schultz 1927. Pap. Mich. Acad. Sci. Arts Letts. [1926] 7: 417-32). Scott and Crossman (1973. *Freshwater Fishes of Canada*) discussed and provided additional data on geographic variation in this character.



Shaded areas in CA indicate approximate range (Moyle 1976. *Inland Fishes of California*).

DISTRIBUTION AND HABITAT: On Atlantic slope from Maritime Provinces south to FL, west to TX, and north to SA. Widely used as bait and ornamental thus transplanted into many areas including parks, in United States. Miller (1952. Calif. Fish Game 33:7-42) provided details on stocking in southwest. Prefers clean, quiet, vegetated water with access to extensive shallows. Common to abundant in ponds and lakes. Often in streams and rivers where, in sluggish sections, it may be abundant.

ADULT SIZE: 53-234 mm SL.

BIOLOGY: Because of value as forage species, considerable information is available concerning propagation and biology (see Carlander 1969. *Freshwater Fishery Biology* Vol. 1 for summary). Keast and Webb (1966. J. Fish. Res. Board Can. 23: 1845-67) studied foods and concluded it was surface and midwater feeder. Scott and Crossman (1973) provided summary of general biology.

Compiler: D. S. Lee. March 1978.

3 10 00396

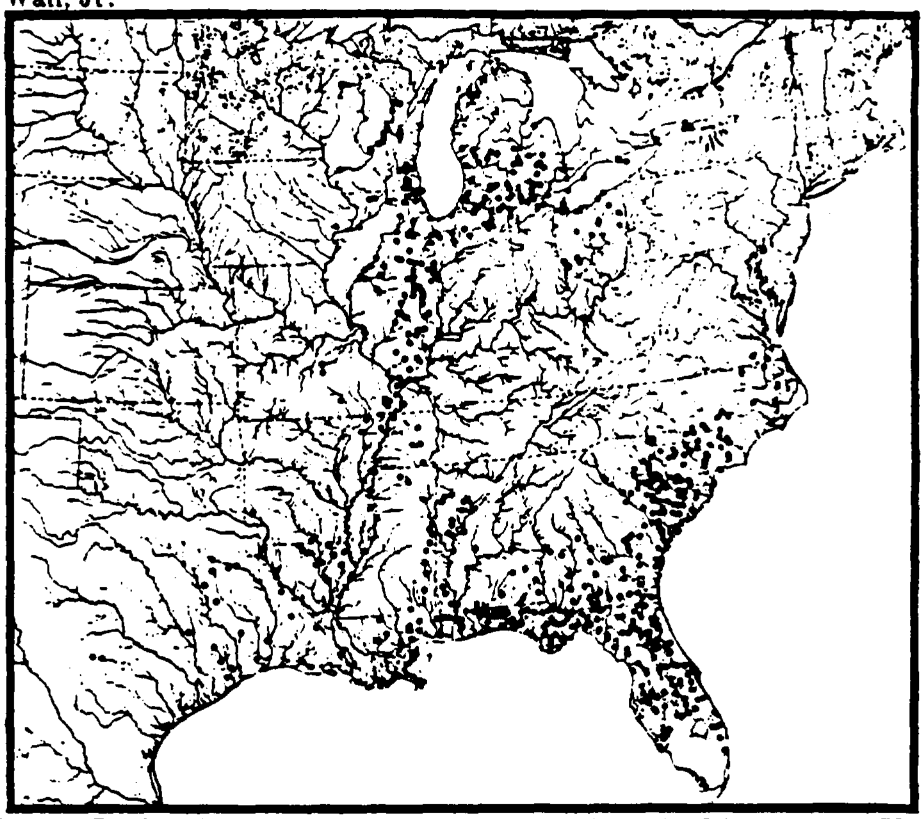
Erimyzon sucetta (Lacepede)
Lake chubsucker

Order Cypriniformes
Family Catostomidae

SC: Barnwell Co., Savannah River system. 173 mm SL (Smith-Vaniz 1968).

TYPE LOCALITY: South Carolina (Lacepede 1803. *Histoire Naturelle des Poissons* 5:1-803).

SYSTEMATICS: Hubbs (1930. Misc. Publ. Mus. Zool. Univ. Mich. 20:1-47) recognized subspecies *E. s. sucetta* and *E. s. kennerlii* (sic), but Bailey et al. (1954. Proc. Acad. Nat. Sci. Phila. 106:109-64) and most subsequent authors have regarded differentiation invalid. Variation in genus currently being studied by B. R. Wall, Jr.



DISTRIBUTION AND HABITAT: Atlantic slope north to VA and south to tributaries of Lake Okeechobee, FL; Gulf slope south to Charlotte Harbor drainage, FL, and west to Guadulupe River system, TX. Mississippi Valley in LA, AR, southeast MO, MS, west TN, west KY, IL, IN, and OH. In southern tributaries of Great Lakes drainage to lakes Michigan, Huron, Erie, and Ontario. Found on Canadian side of lakes Erie and St. Clair. Common on lower Coastal Plain; less abundant in inland portions of range. Occupies ponds, oxbows, sloughs, impoundments, and similar waters of little or no flow that are clear and have bottoms of sand or silt mixed with organic debris. Aquatic vegetation usually present. Abundance apparently declining in areas subject to siltation.

ADULT SIZE: 130-386 SL mm.

BIOLOGY: Odum and Caldwell (1955. Copeia:104-06) investigated respiration in anaerobic FL spring. Hildebrand (1967. Trans. Am. Fish. Soc. 96:414-16) studied effects of herbicides on fertilized eggs and fry. Reproductive biology summarized by Scott and Crossman (1973. *Freshwater Fishes of Canada*). Overall summaries by Trautman (1957. *The Fishes of Ohio*). Pflieger (1975. *The Fishes of Missouri*), and Smith (1979. *The Fishes of Illinois*).

Compilers: B. R. Wall, Jr. and C. R. Gilbert.
January 1980.

3 10 00337

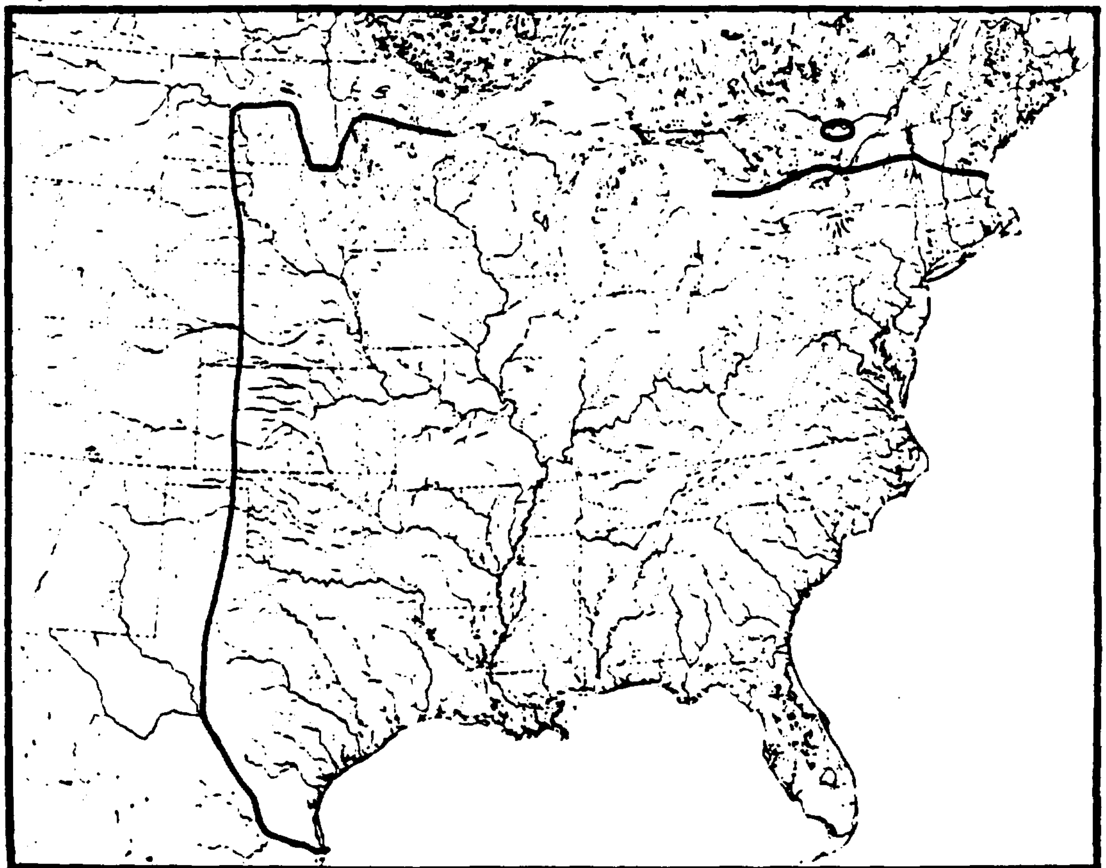
Ictalurus natalis (Lesueur)
Yellow bullhead

Order Siluriformes
Family Ictaluridae

FL: Alachua Co., Gumroot Creek, 64 mm SL (NCSM).

TYPE LOCALITY: "North America" (no locality mentioned) (Lesueur 1819. Mem. Mus. d'Hist. Nat. Paris 5:148-61).

SYSTEMATICS: No definitive systematic study of species. Two subspecies recognized at one time but synomized by Bailey et al. (1954. Proc. Acad. Nat. Sci. Phila. 106: 109-64). Scott and Crossman (1973. *Freshwater Fishes of Canada*) commented that *I. n. erebennus* and *I. n. natalis* still often considered distinct subspecies and provided list of synonyms.



Line encloses native distribution

DISTRIBUTION AND HABITAT: Originally throughout eastern and central United States; also introduced outside native range. Common in areas of heavy vegetation in shallow, clear bays of lakes, ponds, and slow moving streams (Scott and Crossman 1973). Tends to inhabit smaller, weedier bodies of water than *I. nebulosus* in southern part of range. Common.

ADULT SIZE: ca. 380 mm TL.

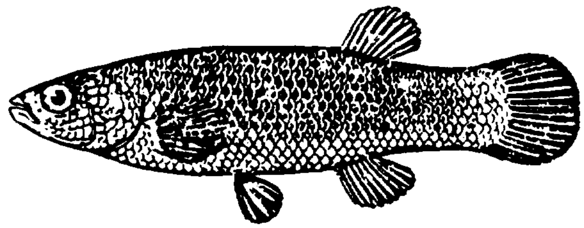
BIOLOGY: Breder and Rosen (1966. *Modes of Reproduction in Fishes*) discussed reproduction. Carlander (1969. *Handbook of Freshwater Fishery Biology* Vol. 1) summarized fishery information, diet, and age class-length relationships. Scott and Crossman (1973) discussed parasites and predators. Yerger (1953. Copeia:115) reported a snake predator. Taste system structure and function described by Atema (1971. Brain Behav. Evol. 4:273-94). Orientation and taste discussed by Bardach et al. (1967. Science 155:1276-78). Chemical recognition, agnostic behavior, and establishment of social hierarchies discussed by Todd (1971. Sci. Am. 224[5]:98-108). Effects of detergents on taste buds reported by Bardach et al. (1965. Science 148:1605-07).

Compiler: G. S. Glodek. August 1979.

3 10 00398

Fundulus chrysotus **(Günther)**
Golden topminnow

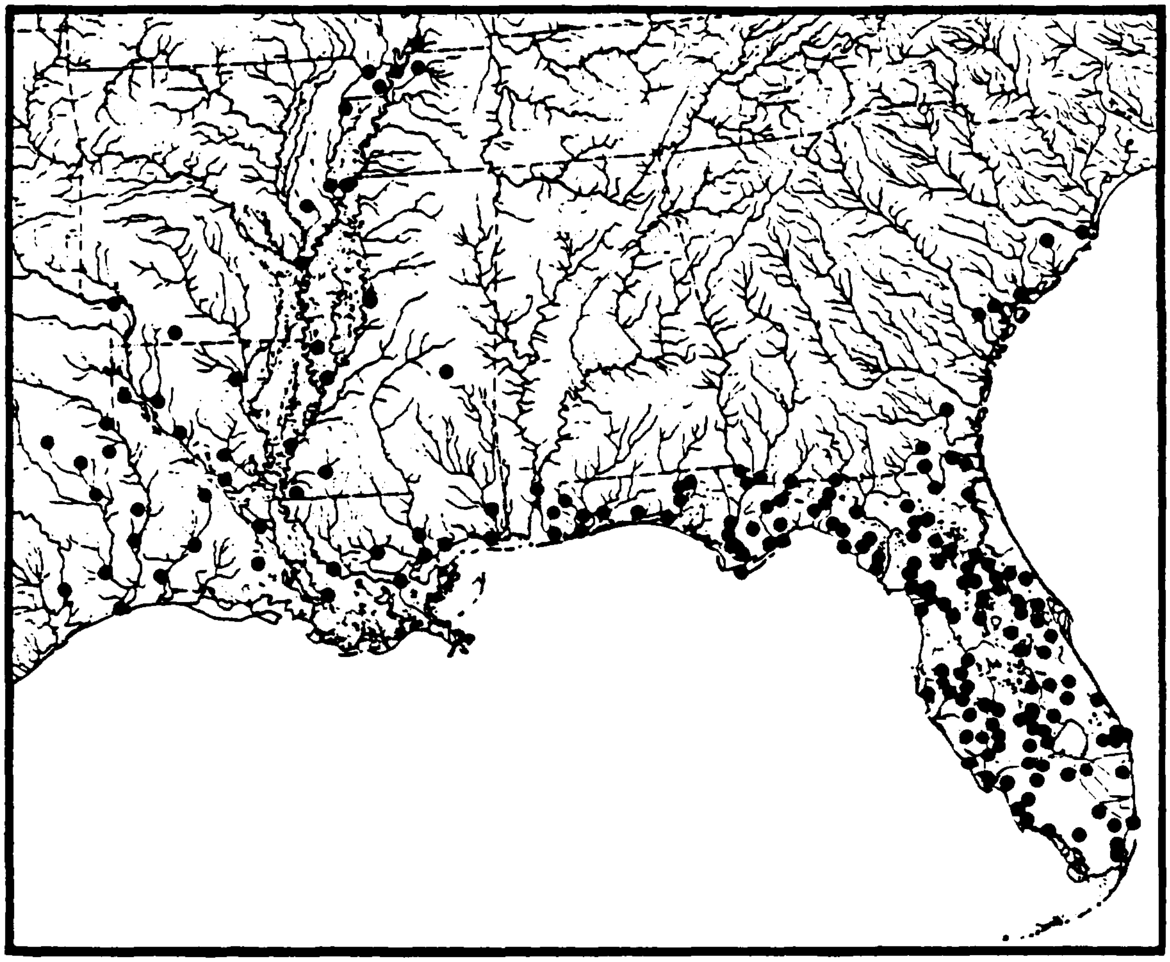
Order Atheriniformes
Family Cyprinodontidae



FL: ca. 56 mm SL (Jordan and Evermann 1900).

TYPE LOCALITY: Charleston, Charleston Co., SC (Günther 1866. *Catalogue of the Fishes in the British Museum* 6:1-368).

SYSTEMATICS: Subgenus *Zygonectes*. In past frequently confused with similar *F. cingulatus*. Brown (1956. Copeia:251-55) diagnosed and compared the two species and defined ranges.



DISTRIBUTION AND HABITAT: Lowland areas (below Fall Line) from SC, GA, and FL west along Gulf to eastern TX and north to extreme southeastern MO and western KY. Inhabits backwaters and pools of ditches and slow-moving streams, usually associated with heavy submergent aquatic vegetation. Occasionally in brackish water along coast. Relatively common in preferred habitat throughout most of range.

DULT SIZE: 30-50 mm SL, 57 mm SL aximum.

BIOLOGY: Feeds mainly on insects and other aquatic invertebrates, near or at the surface (Hunt 1953. Trans. Am. Fish. Soc. [1952] 82:13-33). Leitholf (1917. Aquatic Life 2:141-42) described reproductive activity in aquaria and noted that eggs were deposited on submerged plants, stones, and side of aquarium. Eggs laid a few at a time over period of a week or more. (Pflieger 1975. *The Fishes of Missouri*).

Compiler: J. R. Shute. September 1978.

3 10 00399

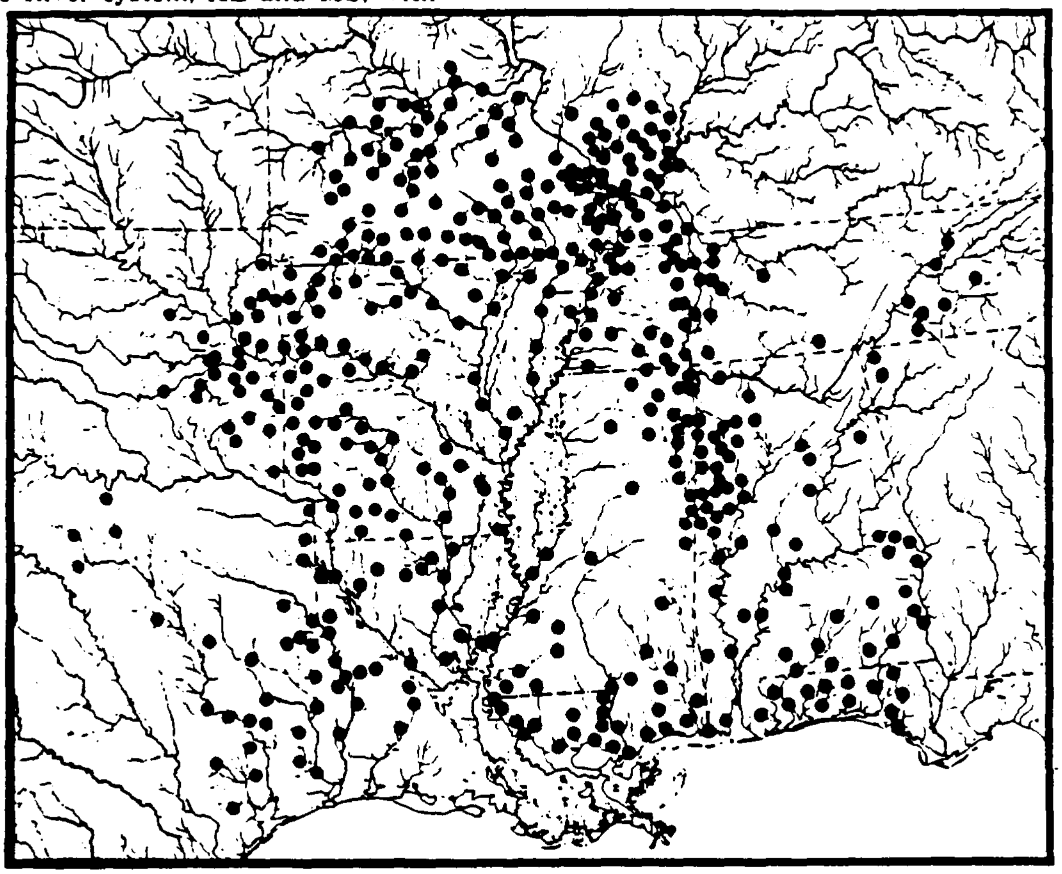
Fundulus olivaceus (Storer)
Blackspotted topminnow

Order Atheriniformes
Family Cyprinodontidae

TYPE LOCALITY: Florence, Lauderdale Co., AL (Storer 1845. Proc. Boston Soc. Nat. Hist. 2:47-49).

SYSTEMATICS: Subgenus *Zygonectes*. Regarded by Hubbs and Burnside (1972. Copeia: 862-65) as distinct genus. Most closely related to *F. notatus* (Braasch and Smith 1965. Copeia: 46-53; Thomerson 1966. Tulane Stud. Zool. Bot. 13:29-47) and an apparently undescribed species from Tangipahoa River, MS and LA. Setzer (1970. Trans. Am. Fish. Soc. 99:139-46) reported basic difference in diploid chromosome number between *F. notatus* (40) and *F. olivaceus* (48) throughout respective ranges, but Black and Howell (1978. Copeia: 280-88) found race of *F. notatus* in upper Tombigbee River system, AL and MS, with 22 pairs.

LA: Lincoln Parrish, Ouachita River drainage, 45 mm SL (Smith-Vaniz 1968).



DISTRIBUTION AND HABITAT: Gulf slope, from Galveston Bay drainage, TX, east to Choctawhatchee River system, FL, and middle Chattahoochee River drainage, GA; north in Mississippi Valley to central MO and southern IL, and east to eastern TN. Prefers small to large fast-flowing, relatively clear, sand-gravel bottom streams where often occurs along margins near thick stands of emergent vegetation. Common but rarely collected in large numbers.

ADULT SIZE: 60-90 mm TL, 97 mm TL maximum.

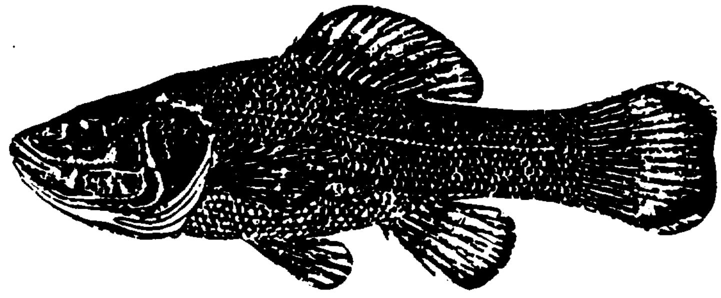
BIOLOGY: Food habits discussed by Rice (1942. J. Tenn. Acad. Sci. 17:4-13), and further studies on biology by Thomerson (1966).

Compiler: J. R. Shute. March 1978.

3 10 00400

Aphredoderus sayanus (Gilliams)
Pirate perch

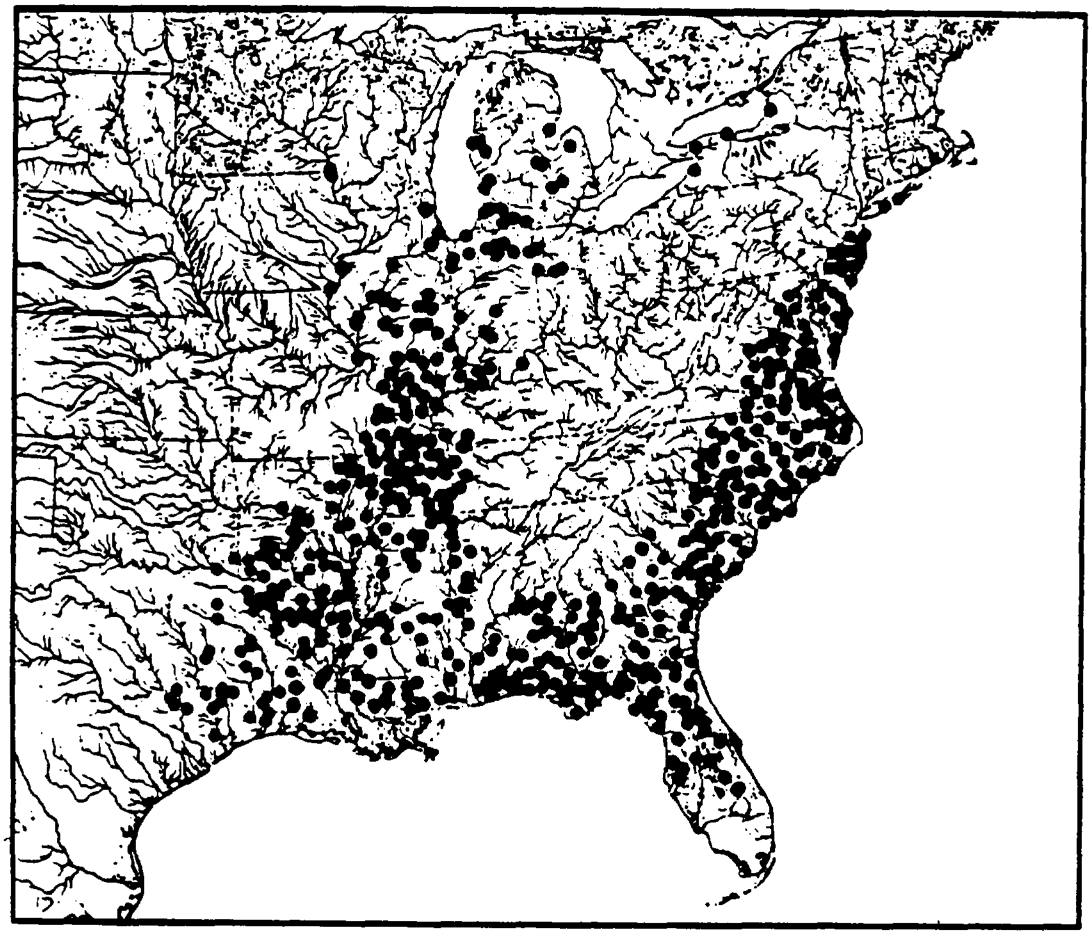
Order Percopsiformes
Family Aphredoderidae



DE: Sussex Co., Raccoon Pond. 69 mm SL. (NCSM)

TYPE LOCALITY: Fishponds, Harrowgate, "near Philadelphia" (Gilliams 1824. J. Acad. Nat. Sci. Phila. 4:80-82).

SYSTEMATICS: Only living member of family. Two recognized subspecies *A. s. sayanus* on Atlantic slope and *A. s. gibbosus* in west. Precise range limits of subspecies and zone of intergradation not recorded in literature, but presumed to be similar to that shown by Crossman (1966. Copeia: 1-20) for *Esox americanus*.



DISTRIBUTION AND HABITAT: Widespread throughout lowlands of Atlantic and Gulf slope. Mississippi Valley. Disjunct populations in Lake Erie and Lake Ontario drainages, western NY. In lakes, ponds, quiet pools, and backwaters of low gradient streams with an abundance of aquatic plants, organic debris and other cover. Rare and localized toward periphery of range (particularly in north), but elsewhere may be very common in preferred habitat.

ADULT SIZE: 64-144 mm TL.

BIOLOGY: Little is known. Recent summary by Pflieger (1975. *The Fishes of Missouri*) provided observations on age and growth. Early growth and development described by Mansueti (1963. Copeia :546-57). Huish and Shepherd (1975. J. Elisha Mitchell Sci. Soc. 91:76) investigated age, movement, density, period of fecundity, and stomach contents of a NC population. Insects are the major food (Becker 1923. Occas. Pap. Mus. Zool. Univ. Mich. 138:1-4; Flemer and Woolcott 1966. Chesapeake Sci. 7:75-89).

Compiler: D. S. Lee. April 1978.

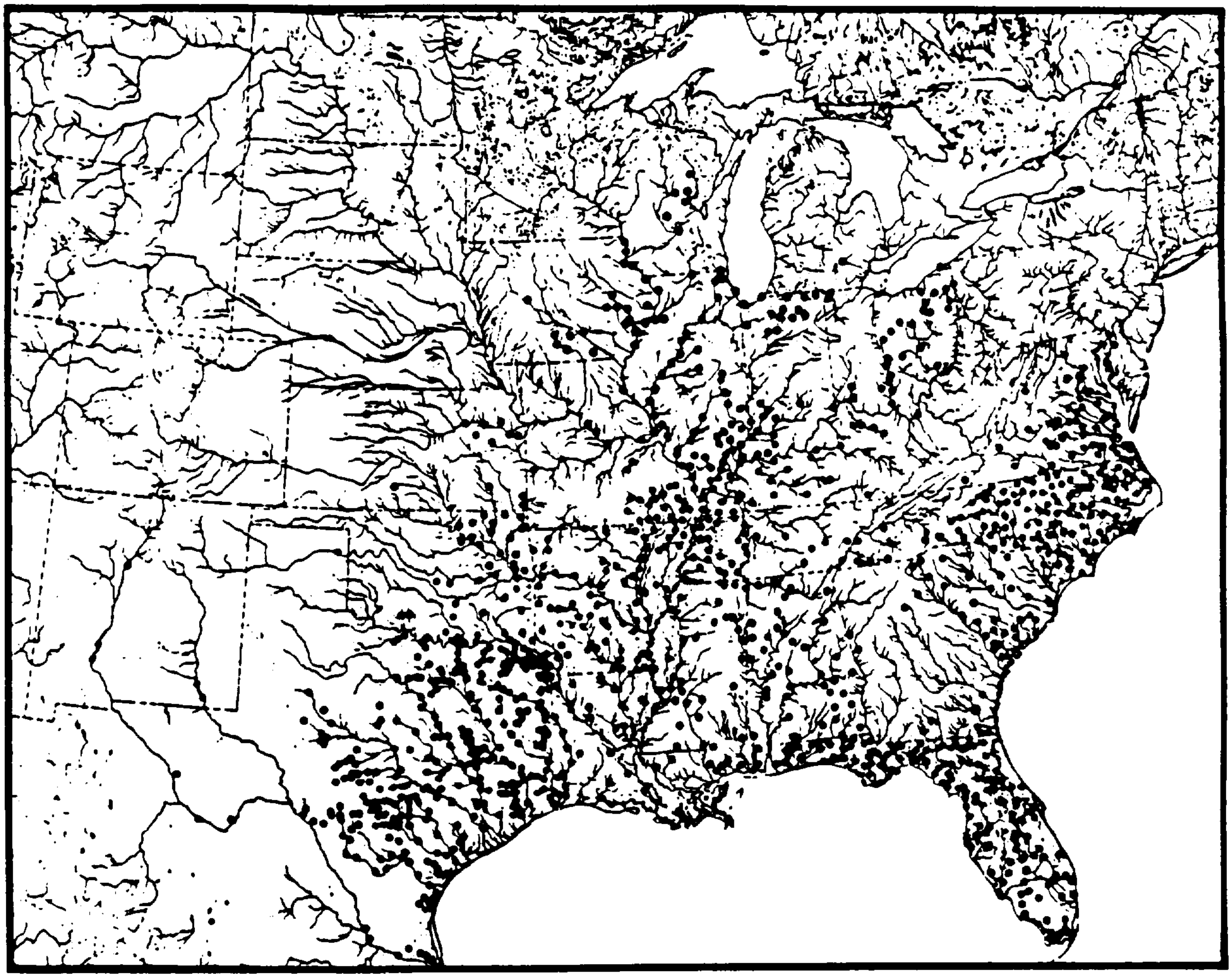
3 10 00401

Lepomis gulosus (Cuvier)
Warmouth

Order Perciformes
Family Centrarchidae

(N.C. Wildl. Resour. Comm. and NCSM)

TYPE LOCALITY: Lake Pontchartrain, New Orleans, LA (Cuvier *in* Cuvier and Valenciennes 1829. *Histoire Naturelle des Poissons* 3:1-500).
SYSTEMATICS: Long placed in monotypic genus *Chaenobryttus*. Placed in *Lepomis* by Bailey et al. (1970. Am. Fish. Soc. Spec. Publ. 6:1-150). Known to hybridize with at least four other *Lepomis* spp., *Micropterus salmoides*, and *Pomoxis nigromaculatus*.



DISTRIBUTION AND HABITAT: Common in ponds, lakes, and occasionally streams, from KS and IA to southern WI, MI, and west PA, south to Rio Grande and FL. Presumed native on Atlantic slope north into VA, perhaps to MD. Transplanted west of Rockies and to portions of Atlantic slope. Occasionally reported in brackish water up to 4.1 ppt. Abundant where introduced in saline water of lowermost Colorado River, AZ (Minckley 1973. *Fishes of Arizona*).

ADULT SIZE: 75-260 mm TL; 284 mm TL maximum.

BIOLOGY: Larimore (1957. Ill. Nat. Hist. Surv. Bull. 27:1-83) studied life history in IL and found nesting from mid-May to August. Nests usually constructed near cover and guarded by male. Feeds mainly on insects, crayfish, and fish. Carlander (1977. *Handbook of Freshwater Fishery Biology* Vol. 2) summarized published information and tabulated data on age, growth, length, and weight.

Compiler: D. S. Lee. December 1978.

3 10 00402

Lepomis macrochirus Rafinesque
Bluegill

Order Perciformes
Family Centrarchidae

(N.C. Wildl. Resour. Comm. and NCSM)

TYPE LOCALITY: "Ohio River" (Rafinesque 1819. J. Physique 88:417-29).

SYSTEMATICS: Three subspecies are recognized. *Lepomis m. macrochirus* occurs in the Great Lakes and north Mississippi basin, *L.m. speciosus* in TX and Mexico and *L.m. purpurescens* on the Atlantic slope from coastal VA to FL (Hubbs and Lagler 1964. *Fishes of the Great Lakes Region*). Widespread introductions have resulted in extensive mixing of these gene pools. Avise and Smith (1974. Evolution 28:42-56) studied geographic variation and subspecific intergradation, and Avise and Smith (1977. Syst. Zool. 26:319-35) studied relationships to other centrarchid species using electrophoretic data. Commonly hybridizes with several other species of *Lepomis*, particularly in areas of ecological disturbance. Considered to be most closely related to *L. humilis* (Branson and Moore 1962. Copeia:1-108).

Former Distribution

Present Distribution

See map on next page

DISTRIBUTION AND HABITAT: Originally restricted to western and central North America where it ranged from coastal VA to FL, west to TX and northern Mexico, and north from western MN to western NY. Widely transplanted elsewhere in North America and introduced into Europe and South Africa. Inhabits shallow warm lakes, ponds, and slow-flowing rivers and creeks often with abundant aquatic vegetation.

ADULT SIZE: 178-203 mm TL. 405 mm TL maximum.

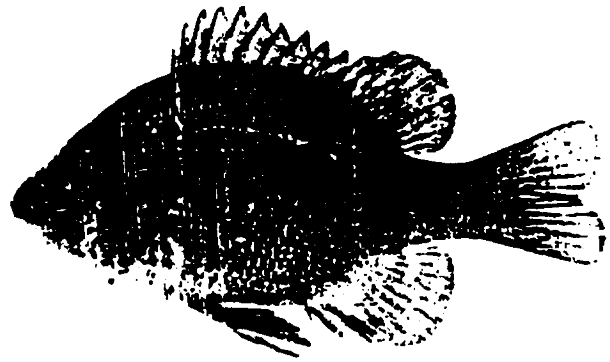
BIOLOGY: Spawning has been summarized by Breder and Rosen (1966. *Modes of Reproduction in Fishes*). This is a generalized wide spectrum feeder. Carlander (1977. *Handbook of Freshwater Fishery Biology* Vol. 2) provided a lengthy summary and discussion of the general biology and of growth data obtained from numerous management studies.

Compiler: D.S. Lee. February 1978.

3 10 00403

Lepomis marginatus (Holbrook)
Dollar sunfish

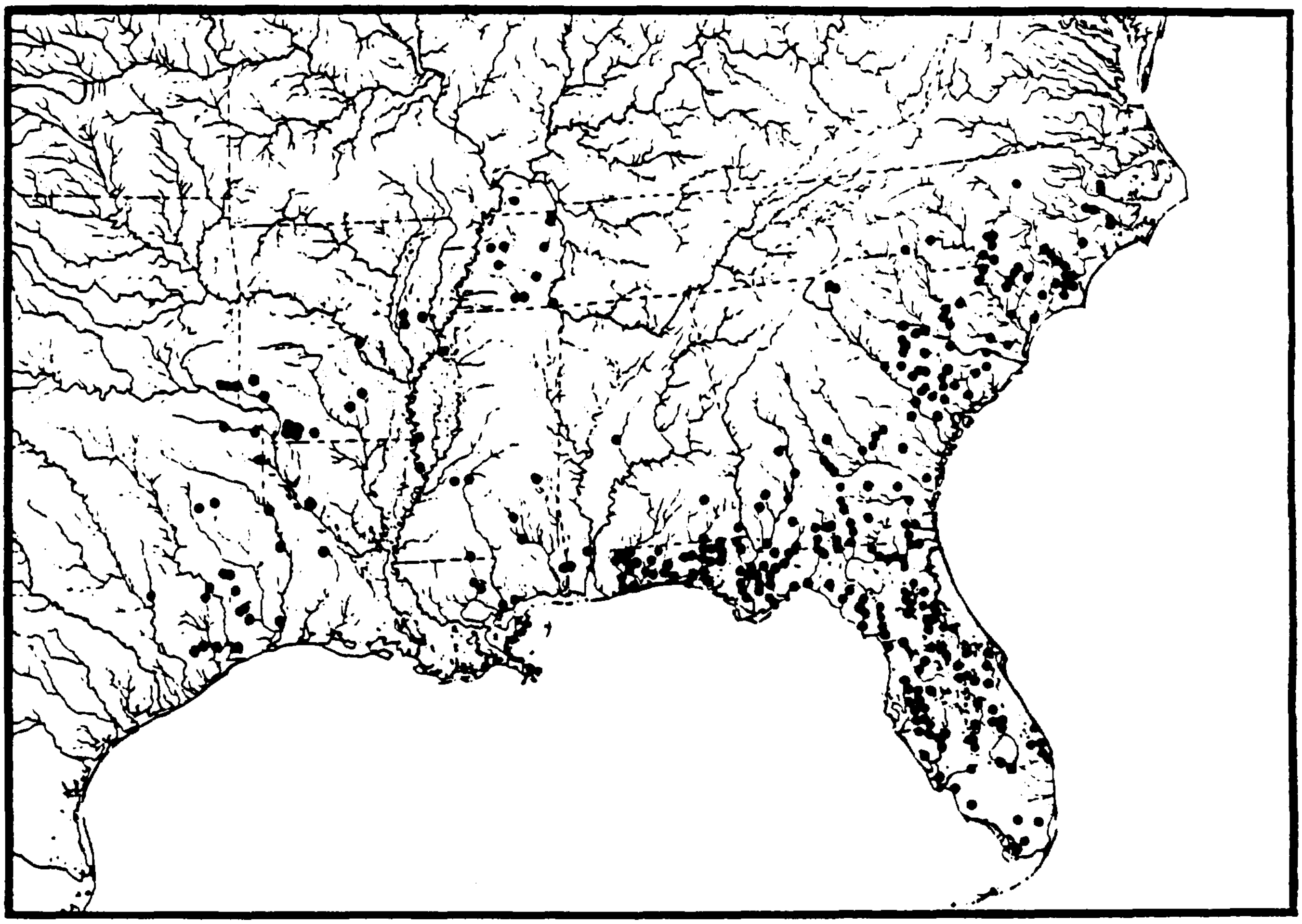
Order Perciformes
Family Centrarchidae



AR: Calhoun Co., Locust Bayou, 72 mm SL (NCSM).

TYPE LOCALITY: St. Johns River, FL (Holbrook 1855. J. Acad. Nat. Sci. Phila. [Ser. 2] 3:47-58).

SYSTEMATICS: Closest relative *L. megalotis*, the two comprising subgenus *Icthelis*. Considered monotypic by previous investigators, but recent studies by compiler indicate possible polytypy. Reeves and Moore (1949. Proc. Okla. Acad. Sci. 30:41-42) gave diagnostic characters for separation from *L. megalotis*.



DISTRIBUTION AND HABITAT: Southern coastal drainages from NC to TX and north through central Mississippi basin to KY and AR. Usually common to abundant. Species of swamps and sluggish streams.

ADULT SIZE: 36-100 mm SL.

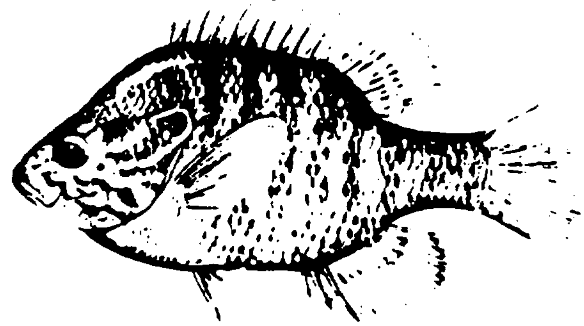
BIOLOGY: Very little information available. McLane (1955 Ph.D. diss., Univ. Florida) classified it as insectivorous and reported breeding season as extending from April to September in St. John's River, FL.

Compiler: B. H. Bauer. December 1978.

3 10 00404

Lepomis megalotis (Rafinesque)
Longear sunfish

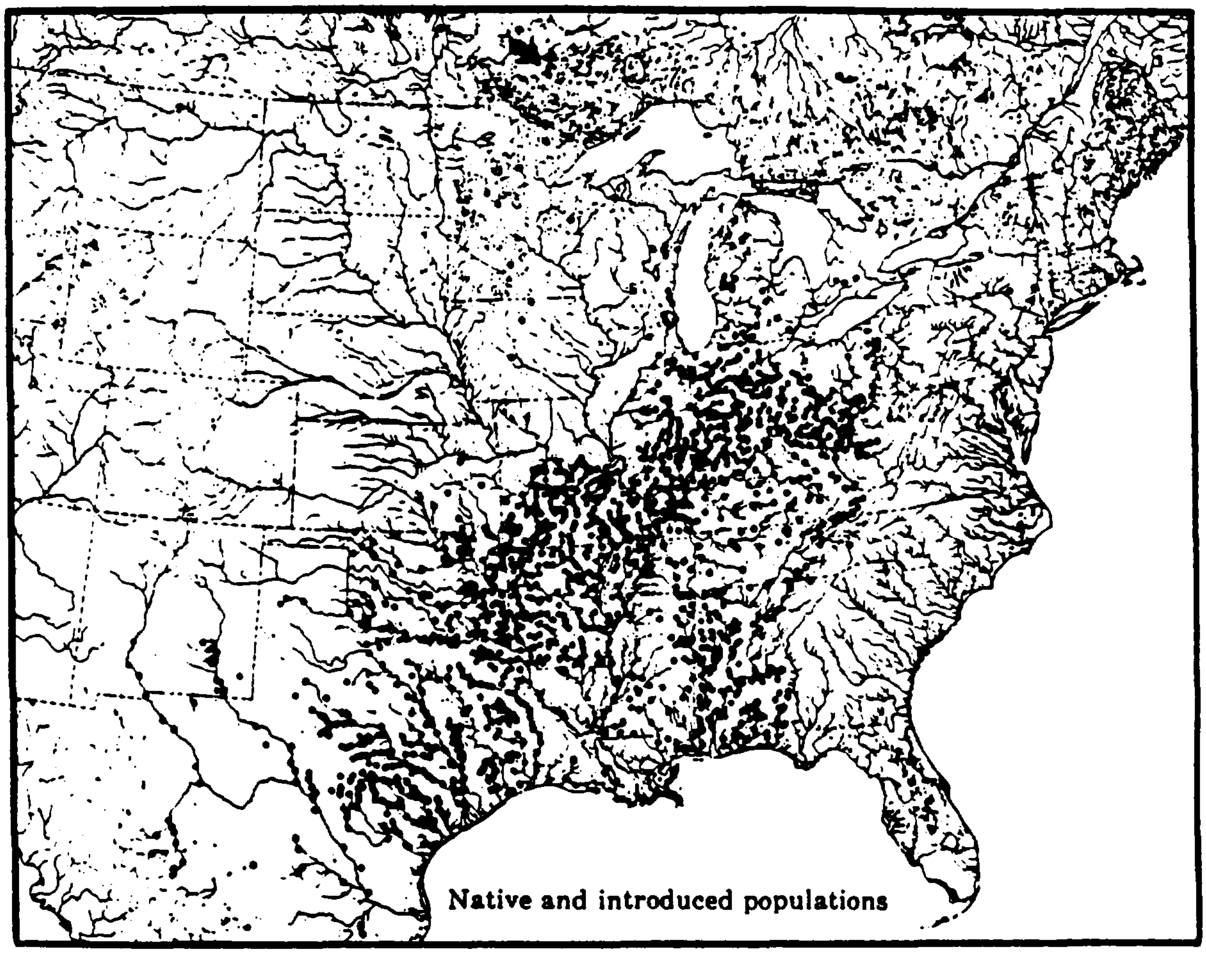
Order Perciformes
Family Centrarchidae



(NMC)

TYPE LOCALITY: Kentucky, Licking, and Sandy rivers, KY (Rafinesque 1820. *Ichthyologia Ohiensis*).

SYSTEMATICS: Closest relative *L. marginatus*, these two species comprising subgenus *Icthelis*. Hybridizes extensively with other *Lepomis*. Most polytypic member of family Centrarchidae, consisting of from four to six subspecies. Presently under study by compiler.



DISTRIBUTION AND HABITAT: Restricted to fresh waters of east-central North America. West of Appalachians, occurs from southern QU south to Gulf of Mexico in AL and western FL. Extends west through TX and Rio Grande tributaries in northeast Mexico, north through eastern parts of the states from OK to southern ON. Now thrives in reservoirs, but typically inhabits small streams and upland parts of rivers, generally absent from downstream lowland sections.

ADULT SIZE: 41 - 200 mm SL.

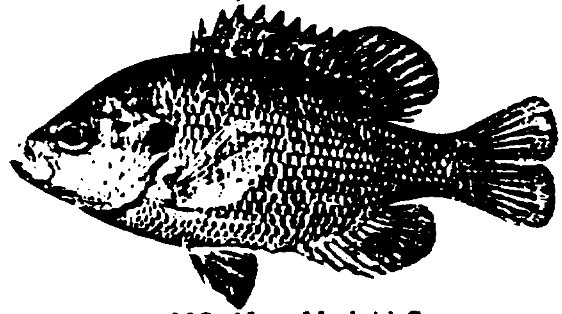
BIOLOGY: Various aspects of life history well studied. Hubbs and Cooper (1935. Pap. Mich. Acad. Sci. Arts Lett. 20:669-96) and Bacon and Kilambi (1968. Proc. Ark. Acad. Sci. 22:44-57) reported on age and growth. Applegate et al. (1966. Proc. 20th Ann. Conf. Southeast. Assoc. Game Fish Comm: 469-82) studied food habits. Numerous authors have studied breeding and mate selection behavior.

Compiler: B. H. Bauer. August 1978.

3.10 00405

Lepomis punctatus (Valenciennes)
Spotted sunfish

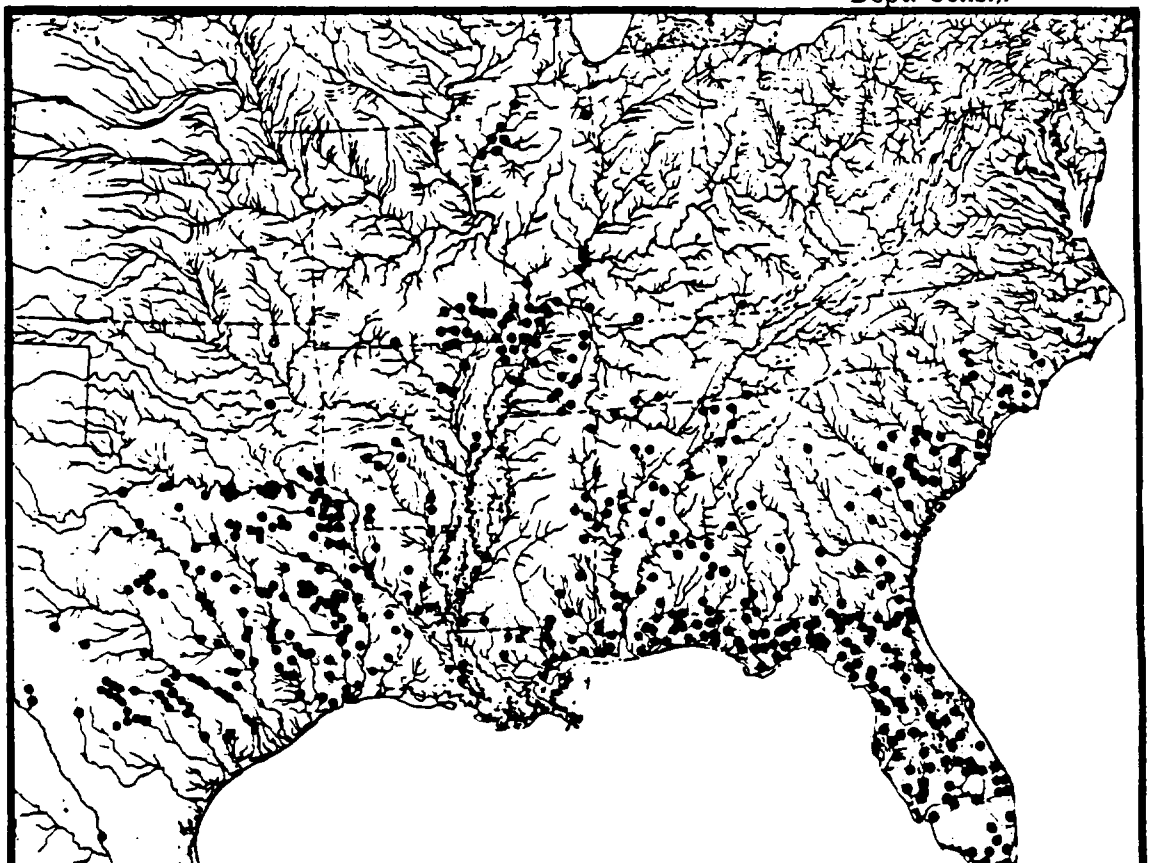
Order Perciformes
Family Centrarchidae



MO: New Madrid Co., Sikeston, 111 mm SL (Mo. Dept. Cons.).

TYPE LOCALITY: Charleston, SC (Valenciennes *in* Cuvier and Valenciennes 1831. *Histoire Naturelle des Poissons* 7: 1-531).

SYSTEMATICS: Two subspecies recognized: *L. p. punctatus* ranging from NC to FL, and *L. p. miniatus* in Mississippi and most Gulf slope drainages; zone of intergradation apparently in extreme west FL (Carr and Goin 1959. *The Reptiles, Amphibians, and Freshwater Fishes of Florida*) and probably AL.



Open circles transplanted populations

DISTRIBUTION AND HABITAT: Southeastern United States from eastern TX east to and including peninsular FL, north along Atlantic slope to southeastern NC. In Mississippi basin north to IL. Common in quiet or moderately flowing waters with heavy vegetation or other cover.

ADULT SIZE: 55-140 mm SL, ca. 200 mm TL maximum.

BIOLOGY: Forbes and Richardson (1920. *The Fishes of Illinois*) reported spawning in May in IL. Pflieger (1975. *The Fishes of Missouri*) noted nesting in July in MO and commented on various aspects of life history. Carr (1946. Q. J. Fla. Acad. Sci. 9:101-06) studied courtship, spawning, and nest defense habits in FL, and recorded spawning from early spring to November. Courting males make grunting sounds (Gerald 1971. Evolution 25:25-87). Carlander (1977. *Handbook of Freshwater Fishery Biology* Vol. 2) summarized available weight, age, and growth information.

Compiler: D. S. Lee. November 1978.

Micropterus salmoides (Lacepede)
Largemouth bass

Order Perciformes
Family Centrarchidae

(N.C. Wildl. Resour. Comm. and NCSM)

TYPE LOCALITY: "les rivieras de le carolina"; Charleston, SC, regarded as probable type locality (Lacepede 1802. *Histoire Naturelle des Poissons* 4:1-728).
SYSTEMATICS: Subfamily Lepominae, tribe Micropterini. Formerly placed in monotypic genus *Huro* (Hubbs 1926. Misc. Publ. Mus. Zool. Univ. Mich. 15:1-77; Hubbs and Bailey 1940. Misc. Publ. Mus. Zool. Univ. Mich. 48:1-51). Hubbs and Bailey (1940) reviewed systematics, and Bailey and Hubbs (1949. Occas. Pap. Mus. Zool. Univ. Mich. 516:1-40) defined and mapped distinctive subspecies, *M. s. floridanus*, endemic to peninsular FL.

Former Distribution

Present Distribution

DISTRIBUTION AND HABITAT: Original range from northeastern Mexico to FL, much of Mississippi River, north to southern QU and ON and on Atlantic slope north only to southern or central SC. Precise original distribution masked by numerous undocumented transplants. Robbins and MacCrimmon (1974. Biomanag. Res. Cent.:1-196) extensively surveyed nearly worldwide introductions. Prefers clear, quiet waters vith aquatic vegetation. Common to abunant throughout most of range.

ADULT SIZE: ca. 120 mm - 700 mm TL.

BIOLOGY: One of most important North American gamefish and much information available. Summaries of life history and propagation information available in Scott and Crossman (1973. *Freshwater Fishes of Canada*) and Carlander (1977. *Handbook of Freshwater Fishery Biology* Vol. 2). Heidinger (1974. An Indexed Bibliography of the Largemouth Bass, *Micropterus salmoides*) provided extensive bibliography.

Compiler: D. S. Lee. February 1978.

3 10 00407

APPENDIX XXII

LOCATION OF CARBON TETRACHLORIDE STORAGE
AND SPILL AREA AT THE LEMOYNE PLANT

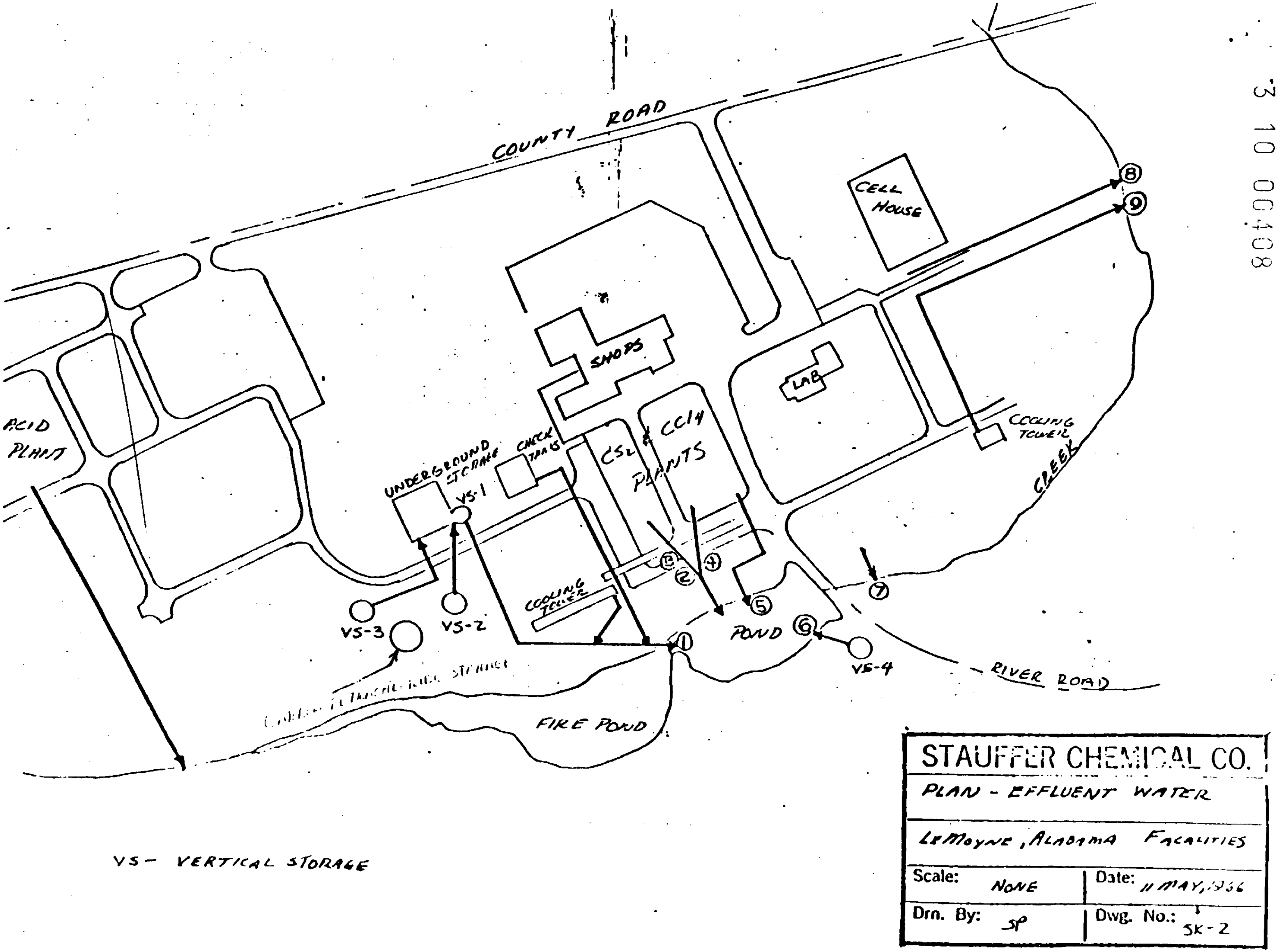


Figure 22-1 Location of Carbon Tetrachloride

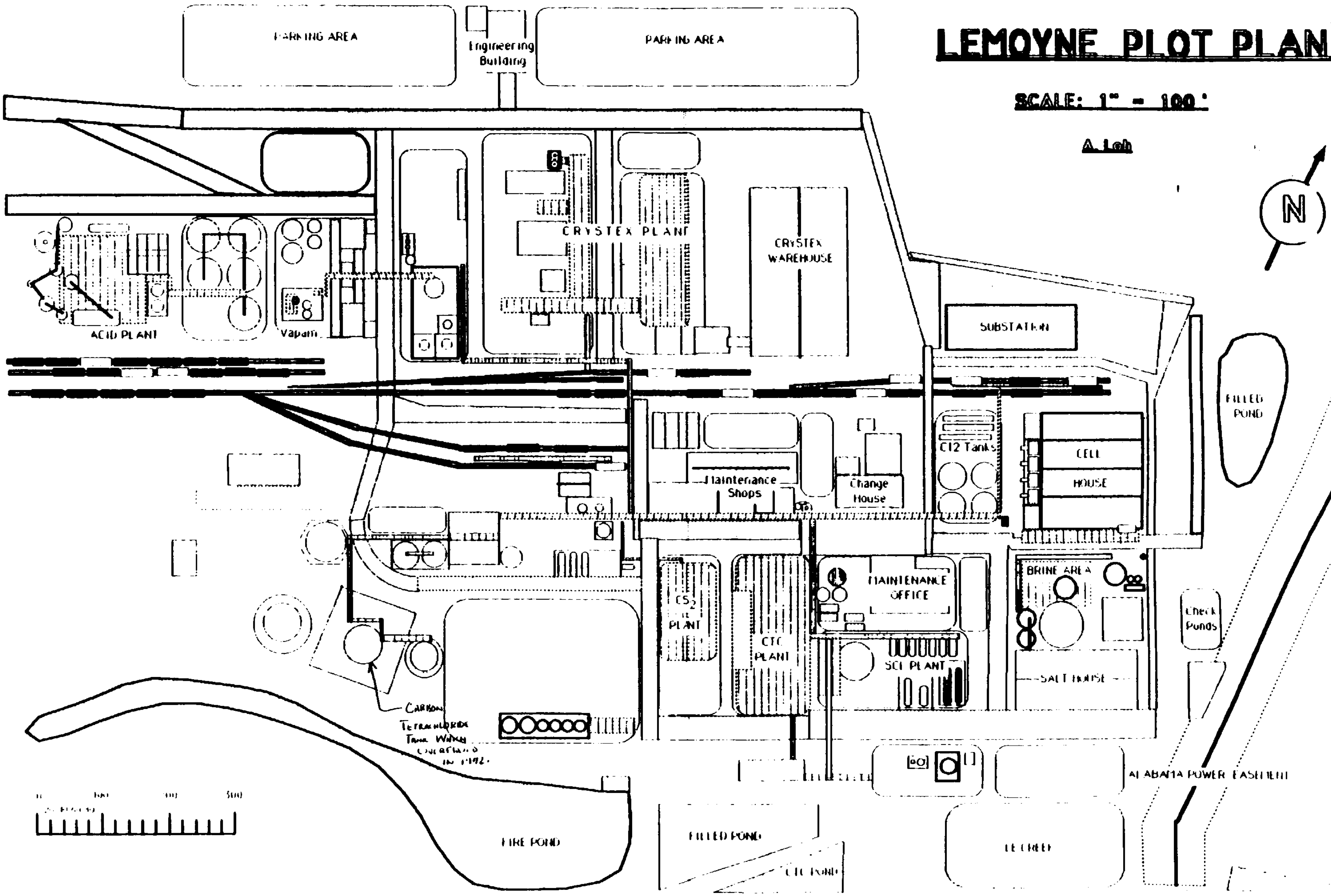


Figure 22-2 Location of Carbon Tetrachloride Storage Tank and Spill Area

3 10 00409

3 10 00410

APPENDIX XXIII
GROUND-WATER INTERCEPT AND TREATMENT PROGRAM

1. GROUND-WATER INTERCEPT SYSTEM

The interceptor well system was originally designed to depress the ground-water table to the extent necessary to act as an effective hydraulic barrier to the southward movement of contaminants. Normally, without the intercept system, approximately 0.5 million gallons of ground water per day pass the southern property boundary of the site. At maximum design pumping rates of 1500 gallons per minute (gpm), the intercept wells remove about 2 million gallons per day. Since 1982, pumping rates have varied between 1,000 and 1,300 gpm. These pumping rates are sufficient to remove the contaminated ground water as evidenced by the very low contaminant levels south of the site boundary (see Section 5.0).

The only major problem associated with operation of the intercept wells has been the measurement of flow in the wells, not flow itself. A minor problem associated with the wells has been the precipitation of aluminum oxide in wells IW-2 and IW-3. The precipitation of aluminum oxide has resulted from the dissolution of clay minerals in the strata surrounding the wells by the slightly acidic ground water that the wells intercept. The aluminum precipitate has been cleaned from these wells on an as-needed basis in order to maintain adequate flow rates. Thus, wells IW-2 and IW-3 have been out of service periodically for cleaning and/or repair since 1980. A submersible pump was used while the wells were being serviced in order to maintain adequate flow rates.

2. GROUND-WATER TREATMENT PROGRAM

In December of 1979 and January of 1980, Stauffer Chemical Company conducted treatability tests on contaminated ground water taken from the aquifer in the proposed interceptor well system area. The attached "Treatability Report, January, 1980, Air Stripping" describes the results of those tests. The effects of air stripping the two volatile chemicals, carbon tetrachloride (CTC) and carbon disulfide (CS_2), by spraying through nozzles and by floating mechanical aerators were measured. The test results indicated that ground water containing relatively high concentrations of carbon tetrachloride (up to 80 ppm) and carbon disulfide can be successfully aerated to produce an effluent with volatile concentrations of 50 ppb or less.

Since 1980, when the ground-water treatment system was designed, the concentrations of carbon tetrachloride and carbon disulfide in the ground water have decreased from up to 80 ppm to less that 10 ppm. Because the spray nozzles in the ground-water treatment system perform the bulk of the removal of the contaminants (greater than 90% removal), and because NPDES permit levels for discharge of CS_2 and CCl_4 in treated water were not being exceeded with use of the spray nozzles alone, a decision was made to discontinue use of the mechanical aerators.

Attached to the treatability report are notes on potential remedial action technology for CMA's Solidwaste Work Shop (8/23/83), and a schematic of the aeration system.

3 10 00413

ATTACHMENT 1

TREATABILITY REPORT

JANUARY, 1980

AIR STRIPPING

3 10 00414

VOLATILE GAS STRIPPING SYSTEM DESIGN RECOMMENDATIONS

BASED on TEST CAMPAIGN RESULTS

LeMOYNE GROUNDWATER IMPROVEMENT PROGRAM

APPROPRIATION REQUEST # 1625A660

January 1980

T. Helfgott Ph.D., P.E.

3 10 00415

OUTLINE

Nomenclature
Terms Used

Ø	=	diameter
MG	=	Million Gallons
mg	=	milligrams
1 ppb	=	1 μg/l
1 mg/l	=	1 ppm = 1000 ppb = 1000 ug/l
Gpm	=	Gallons per minute
hp	=	horsepower

3 10 00416

I. PURPOSE

A. The overall purpose of this project is to have a groundwater treatment system that takes 1500 gpm water from a carbon tetrachloride and carbon bisulfide laden aquifer by means of intercept wells, aerates the water with spray nozzles and mechanical aerators, raises the pH of the water to meet river discharge standard (pH 6-9) and discharges the water essentially free of the two volatile gas (each less than 50 ppb) (50 $\mu g/l$) into the Mobile River. The discharge standard of less than 30 mg/l total suspended solids must also be met.*

B. The intent of this report is to offer the basis for design recommendations for the volatile gas stripping system in the LaMoyne Groundwater Improvement Program. The one month** long test campaign at the LaMoyne facility had three major objectives:

1. to size mechanical aerators in terms of horsepower rating and select number of aerators necessary to achieve required residual volatile gas levels.

2. to affirm that the 50 $\mu g/l$ standard could be met; and

3. to collect nozzle stripping performance data.

---

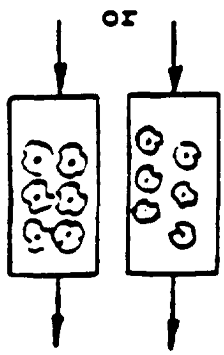
* Since the groundwater contains 4-30 mg/l Fe^{++} it is anticipated that at least part of the time greater than 30 mg/l TSS will be generated largely as hydrated iron floc - $[Fe(OH)_3 \cdot 6\ H_2O]$.

** 17 December 1979 thru 15 January 1980. As of this time, however, all requested tests have not been done, and all data is not yet available.

. 3 10 00417

II. SUMMARY

Based on the test campaign results at the LeMoyne facility "Carbon Tet" pond, the following volatile gas stripping system is recommended:



A. Six (6) mechanical aerators each of 20 horsepower rating in a pond arranged in either of the conformations shown in the margin. See picture of the floating aerator in the Appendix.

B. Pond size can be selected on the basis of marginally overlapping zones of turbulence between aerators in order to realize a relatively long narrow pond and smallest area.

C. Detention time under aeration is not critical controlling parameter for these rapid surface renewal machines arranged as suggested.* For the eight foot depth of pond the pumping function of the mechanical aerators should easily satisfy the need for rapid turnover of the water under treatment.

D. Twelve full cone spray nozzles rated at 125 gmp and 30 psig non-clogging (1 3/4" Ø) orifice are recommended**.

---

* Detention time would be a problem for unmixed ponds of very short retention periods or for very long detention times for low flow-through.

** See in appendix vendors letter of 7 January 1980.

II. SUMMARY - (cont'd)

Compared to the preliminary design, the recommended gas stripping equipment, based on the test campaign, can save 40% of the capital cost for the mechanical aerators and over 50% of the operating power cost since 6 units at 20 horsepower are suggested rather than 10 units at 25 horsepower.

III. TEST DESCRIPTION AND RESULTS

Figure 1 is a schematic flow sheet of the "Carbon Tet" pond at LeMoyne that was used to treat the groundwater. Only 2 (out of 4) of the wells in the well field of the aquifer could be used at the time of the test. Each pump was rated at 75 gpm. Due to production needs, 30 gpm of low carbon tetrachloride (roughly 10 to 1000 ppb) containing effluent at pH 7 also went into the pond. Flat spray nozzles (1 inch opening) at an operating pressure and flow (though much below rated capacity) were used. As shown on the flow sheet the pond was 1.5 MG size with a baffle at a 2/3 point to attempt to segregate the aeration zone from the settling zone. At the (Western) end of the pond a simple overflow collection though is used. Typical operating parameters are flagged on the flow sheet and the 5 major sampling points are indicated. Table I lists the data summary for the 5 tests (A through E) for which data are available at this point. Data accumulated are attached to the appendix of this report.

III. TEST DESCRIPTION AND RESULTS - (cont'd)

A. For the first test, the aerators were turned off and the pond was influxed with the well water containing about 86 ppm CCl_4. The concentration in the pond rose from 0.001 ppm (1 µg/l) to just below 7 ppm where the concentration started to plateau after six days. Figure 2 shows the concentration charges of CCl_4 with time that would imply a detention time of the pond (without mixing) of roughly 6 days, or 4 days for up to the baffle (2/3 of the 1.5 MG volume of the pond). This corresponds to the time in this pond for the flow rate anticipated.

The outlet concentration of CS_2 was 0.37 ppm (370 µg/l) while the well water had an average concentration of about 3.2 ppm (3,200 µg/l). Since there was no mechanical aerator used in this test most of the removal is to be due to the nozzles (88%).

B. In the next test, two aerators were turned on which drew 31-32 amperes per unit. In less than a day or so, the final effluent went to 0.3 ppm CCl_4 (300 µg/l) and remained about this value. This is taken as the lowest value that can be achieved by one set of two aerators following an initial reduction of better than 90% by the nozzle.

Since only 17½-18 hp (horsepower) were drawn by each 25 hp aerator these could be specified as 20 hp units. The 25 hp units would be more appropriate if this were a thicker wastewater rather than a relatively clean groundwater.

3 10 00420

III. TEST DESCRIPTION AND RESULTS - (cont'd)

Although CS_2 data is sparse values as low as 12 ppb (12 µg/l) were noted for the effluent in this test. The average well water CS_2 concentration was about 3.2 mg/l (3,200 µg/l) so an adequate overall reduction of better than 99% is achievable.

C. In the third test, one aerator was left on and the effluent quality went to about 0.7 ppm (700 µg/l) in less than the anticipated full detention time of the pond indicating a highly mixed system. In general, better than 90% removal is still noted for the nozzles which are doing the bulk of the removal in terms of lbs CCl_4 stripped. The mechanical aerators are needed to polish the groundwater to the discharge standard.

D. The fourth test used two aerators with the nozzles at 2 psig. The average removal across the pond assignable to the 2 mechanical aerators alone was 89% (0.450 to about 0.05 ppm for 7 sets of average data).

E. It was necessary to be sure that a 50 ppb (50 µg/l) or better of CCl_4 could be reached. In this last test, the wells were shut off and the production effluent concentrations were noted. For average beginning of pond values of about 100 ppb (100 µg/l), end of pond values below 10 ppb CCl_4 were achieved. For the few data points for CS_2 the values were below 50 ppb (41 & 13 ppb).

In this test samples were also taken from the middle of pond and compared to the outlet concentration: for 5 match sample sets there was no significant difference in concentration. From this it is concluded that except for the inlet side of the pond (~~East~~ West), the pond is uniformly mixed from at least the middle area to the effluent area*. A visual flow pattern could be seen in the pond due to the black-brown iron sludge content: see reactors shown in flow sheet. The iron was dispersed uniformly after the first mechanical aerators.

F. Quantitative Results

Quantitative results are summarized on Table II. Because the pH was not controlled in the test, the pH ranged from 3.0 to 5.5 at the influent point; it was 4.6 as an average. Typically the well water has a pH of 5.3 but because some iron precipitated there was acid generation. The pH of the production water was 7.0. Suspended solids, roughly correlated to turbidity, did not change much. The settling sone beyond the baffle was not very effective. Turbulent eddies could be seen by-passing the plastic baffle curtain. The alkalinity of the well water was generally low, typically about 17 mg/l $CaCO_3$ eq., and the acidity is typically about 70 mg/l $CaCO_3$ eq. Figure 3 is a titration curve from earlier tests on the groundwater showing other water quality information and alkaline requirements

---

* At this time, sampling in depth in the pond has not been done yet but for the high mixing reigm of the aerators uniform distribution from bottom to top of pond is expected.

III. TEST DESCRIPTION AND RESULTS - (cont'd)

in terms of caustic, lime, or calcium carbonate to achieve a pH of about 6. A major advantage of $CaCO_3$ is that it would tend to buffer the water system at about 6.3 while not adding sodium and improving the overall water quality in terms of hardness and alkalinity.

IV. INTERPOLATION AND ANTICIPATED PERFORMANCE

With the limited data on hand, the task now is to interpolate the information for a full design. At this time, we have the following information: (1) We know what the nozzle can do — better than 90% in most cases. (2) We know that a set of 2 aerators with a starting influent concentration of about 3-4 ppm can reduce this to about 0.3 ppm (300 µg/l). (3) We know there is little influence (less than 10% CCl_4 removed) accountable for the settling zone; that is, between the baffle and the pond outlet there is no significant change in CCl_4 concentrations. (4) We know that if we start into the pond at lower concentrations using a set of 2 mechanical aerators the following CCl_4 levels can be accomplished:

Test D: 0.450 ⟶ 0.049 (89%)

Test E: 0.103 ⟶ 0.010 (90%)

The data for CS_2 is very sparse but the very limited information indicates about 90% plus removal by the nozzle is possible and that effluent concentrations below 50 ppb (50 µg/l) can be reached. The initial concentration of CS_2 is less than 10% of that for CCl_4 and it is anticipated that CS_2 is more readily stripped from the water phase into the air.

From this data we can assemble a CCl_4 removal diagram, Figure 4, so that each bar represents a set of 2 aerators following the initial removal by the nozzle. From the graph we can see by extrapolation that three sets of 2 aerators would more than be minimal to go below 50 ppb and the 2 sets of 2 aerators following the nozzles would be marginal at best.

IV. INTERPOLATION AND ANTICIPATED PERFORMANCE - (cont'd)

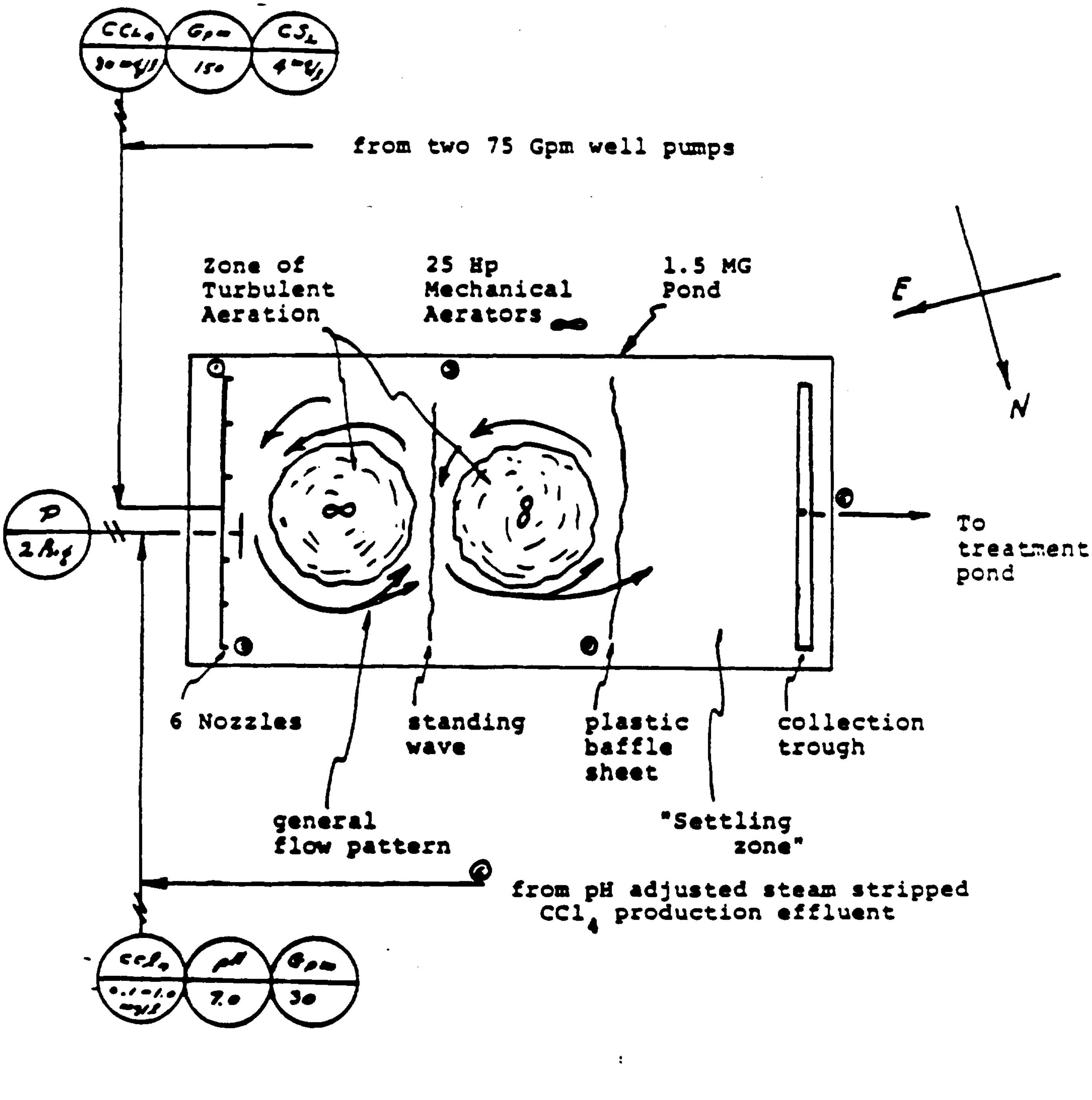
Table V shows the anticipated performance of the system assuming three levels of well water CCl_4 -- 30 ppm CCl_4 the original design figure; and the 60-80 ppm CCl_4 that was seen during the recent test campaign. Therefore, a conservative design would be for 6 aerators and 4 or 5 aerator units would be the margin selection. The aerator rating can be 20 hp based on the actual power drawn and noted during the tests.

Since the preliminary design called for 250 hp (10 x 25 hp units) the test campaign has realized a better than a 50% power saving as well as a lesser number of mechanical aeration units.

3 10 00425

Figure 1

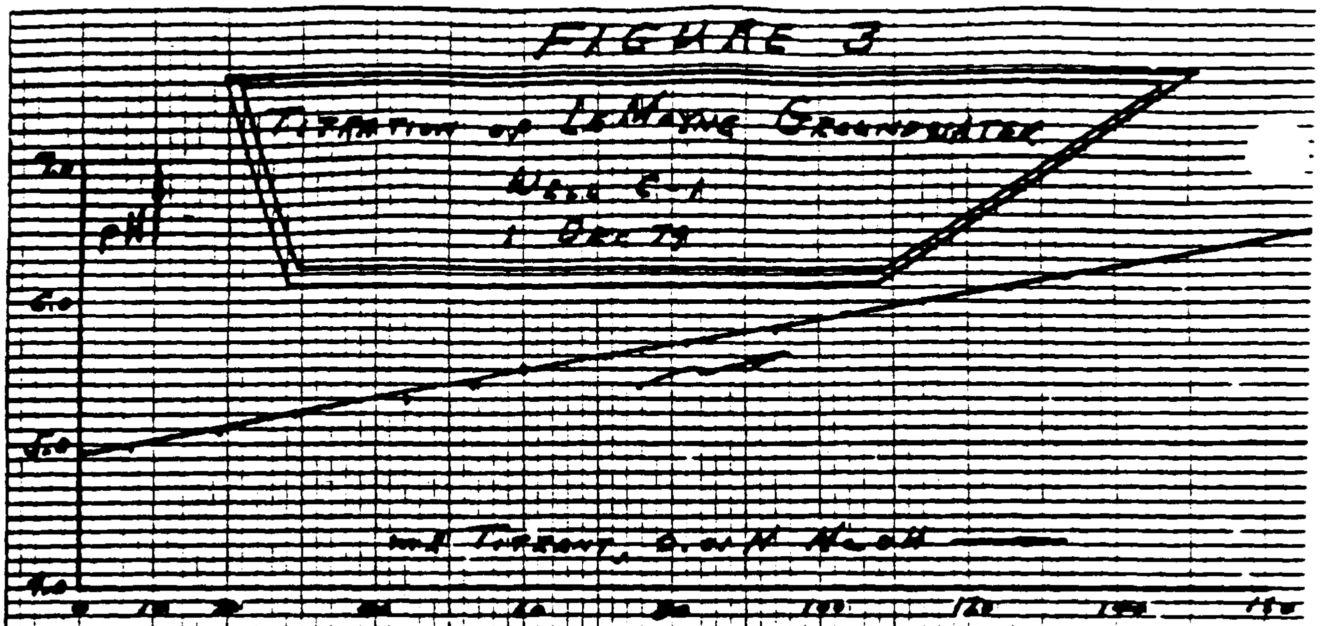
"Carbon Tet" Pond at LeMoyne



Size of zone of turbulent aeration: approximately 100 ft Ø

Five major sampling points indicated

Approximately 1.0 MG water under mixing and rapid aeration



	Influent	
pH	4.95	6.00
CCl_4 mg/l	1.33	1.09
CS_2 mg/l	0.10	0.080
TSS mg/l	1.0	25.0
Fe mg/l	0.52	0.38
Settleable	=	2.0 ml/l in 2 hours; 10 ml/l overnight

[illegible]

$$343 \ \frac{\text{lb NaOH (100\%)}}{\text{MG}}$$

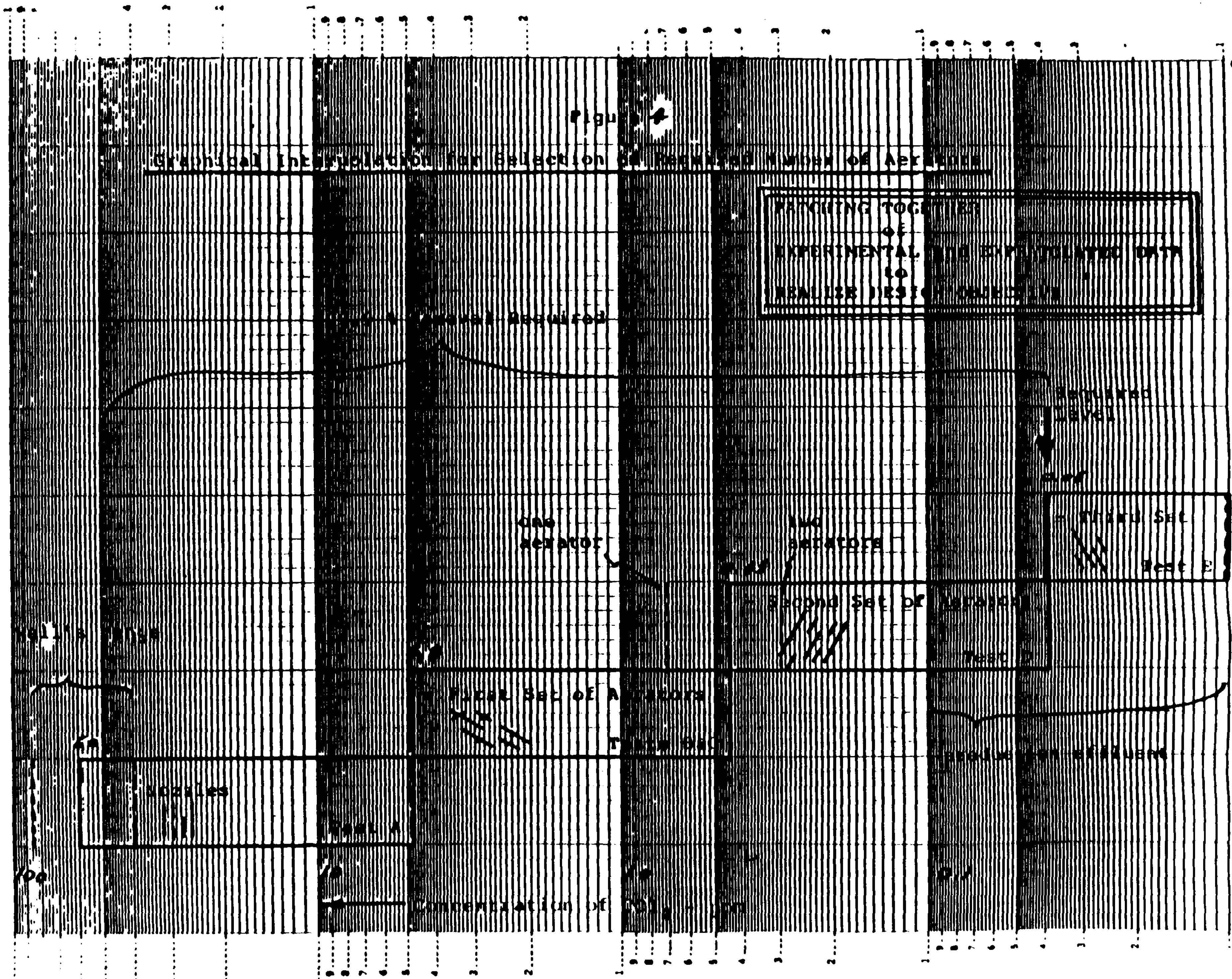
or

$$429 \ \frac{\text{lb } Ca(OH)_2 \text{ (100\%)}}{\text{MG}}$$

or

$$858 \ \frac{\text{lb } CaCO_3 \text{ (100\%)}}{\text{MG}}$$

[illegible]


EXPERIMENTAL
Required
One
aerator
aerators
Second Set of
Rest
Nozzles
100
0.1
0.01
Concentration of

3 10 00427

3 10 00428

TABLE I

DATA SUMMARY -- GROUNDWATER IMPROVEMENT CAMPAIGN
LeMoyne, Alabama

December 1979 - January 1980

Test	No. of Aerators in Use	Flow From	Major Information Gained
A	0	Wells and Production	Detention Time: 4-6 days Overall Reduction 86 ⟶ 7 ppm CCl_4
B	2	Wells and Production	Power Drain: 18 hp each aerator Nozzle Removal: 86-99% CCl_4 for an average of 96% 40 ⟶ 0.3 ppm CCl_4
C	1	Wells and Production	Nozzle Removal: 93% CCl_4 Overall Removal: 98.8% 60 ⟶ 0.7 ppm CCl_4
D	2	Wells and Production	Aerator Set Removal: 0.4 ⟶ 0.08 ppm CCl_4
E	2	Production Only	Aerator Set Removal 0.1 ⟶ 0.01 ppm CCl_4

Removal % CCl_4 from Influent

Summary of all Tests

Mechanism	Average %	Range %
Nozzle	92	77-99
1 Aerator	82	-
2 Aerators	91	78-99

3 10 00429

TABLE II

Quantitative Information

Turbidity in	12 NTU
Turbidity out	12 NTU
Total Suspended Solids in	11.9 mg/l
Total Suspended Solids out	11.4 mg/l
Iron in	3.7 ppm Fe
Iron out	3.4 ppm Fe
pH in Avg. (Range)	4.6 (6.5-3.0)
pH out Avg. (Range)	3.9 (5.0-2.9)
Well Water pH	5.3 (typically)
Water Temperature	66° F (19° C)
Well #29	162 ppm CCl_4
Well #31	9.5 ppm CCl_4
Ambient Air	$1\text{-}2\times10^{-4}$ ppm CCl_4
Air Temperature	$38\text{-}70^{\circ}$ F ($4\text{-}21^{\circ}$ C)
Acidity	16 ppm $CaCO_3$ eq.
Alkalinity	$\sim$ 70 ppm $CaCO_3$ eq.

3 10 00430

TABLE III

Conservative Design

90%+ Stripping of CCl_4 by Nozzles

90% Stripping of CCl_4 by each set of 2 Aerators

	Concentrations, ppm CCl_4		
Inlet Concentration	30	60	80
Nozzle Outlet	3	6	8
End of 1st Set	0.3	0.6	0.8
End of 2nd Set	0.03	0.06	0.08
End of 3rd Set	0.003	0.006	0.008

Discharge Required 50 ppb - 0.050 ppm - 50 µg/l

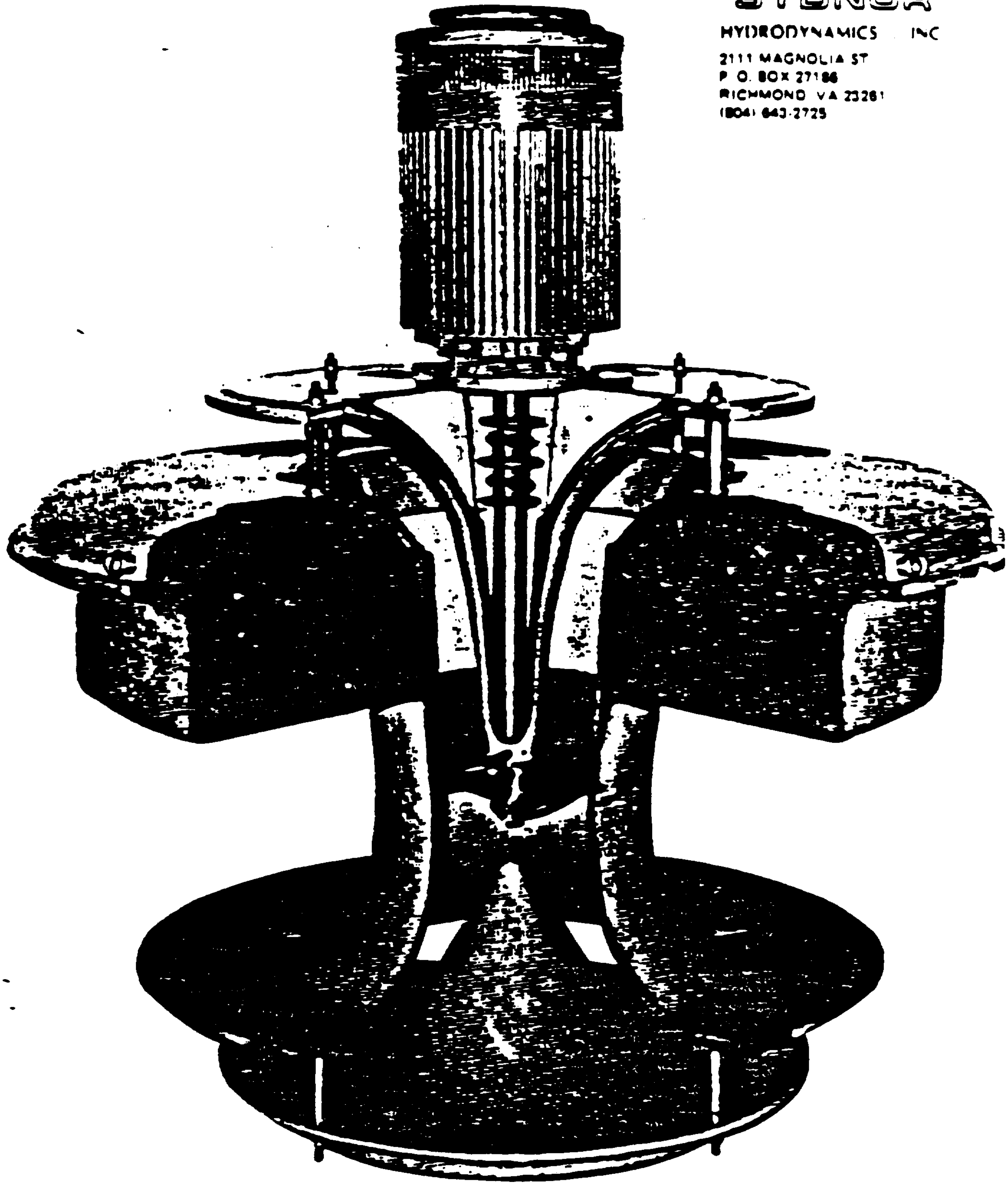
3 10 00431

APPENDIX

1. Picture of System Floating Aeration Used.
2. Letter from vendor, Wm. Steiner Mfg. Co., recommending nozzle specification for the groundwater improvement program.
3. Data Collection

3 10 00432

SYDNOR
HYDRODYNAMICS INC
2111 MAGNOLIA ST
P. O. BOX 27186
RICHMOND VA 23261
(804) 643-2725



CUT AWAY OF THE SYDCO OXYGENATOR SHOWING THE PROPRIETARY DESIGN, QUALITY WORKMANSHIP AND MATERIALS, AND SUPERIOR CONSTRUCTION

3 10 00433

STEINEN

Wm Steinen Mfg Co 29 East Halsey Rd Parsippany N J 07054 • 201-887-6400 • Cable STEINEN • TWX 710-986-8212/STEINENPAPY

January 4, 1980

Dr. T. Helfgott
Stauffer Chemical Co.
Dobbs Ferry, NY 10522

Dear Dr. Helfgott:

This will confirm our discussion yesterday regarding the change of pressure specifications for the spray nozzles in the gas stripping application.

We suggest consideration be given to the following:

Twelve units of the Steinen Hi-Flo Tan-Jet nozzle #THM or THF 14516. This nozzle is rated @ 126 g.p.m. @ 30 p.s.i. with a spray angle of 96°. This will provide a total system flow of 1,512 g.p.m. @ 30 p.s.i.

Due to the solid content of 2,000 p.p.m. as well as a pH of approximately 5 of the solution, we suggest consideration of 316 stainless steel as a material of construction. Since this is a casting, we would require a minimum of six weeks for shipment after receipt of order. The approximate orifice diameter of this nozzle is 1-3/4".

If you develop any further questions, please let me know.

Very truly yours,

John J. Pasquali

John J. Pasquali
Sales Manager
Industrial Division

JJP:js

3 10 00434

46 0060

K•E GENERAL DATA • 7 COLUMNS X 40 LINES
KEUFFEL & ESSER CO.

DATA SHEET No. 2

TEST A

	CCl_4	CS_2		Sample Location
	mg/l	mg/l		
Time Date - Clock				
15 DEC 79 8AM	0.001			
17 DEC 79 8AM	0.001			
18 DEC 79 8AM	0.002		EFFLUENT	2
19 DEC 79 8AM	0.014			
20 DEC 79 8AM	1.48			
21 DEC 79 8AM	6.32	0.37		
20 DEC 79	162		WELL 29	BEFORE 1
	9.5		WELL 31	

No Aerator Used

Water Temperature 66 °F

3 10 00435

DATA SHEET No. 2

TEST B	CCl_4	CS_2	TURBIDITY	TSS	/IRON	pH	ALKALINITY / ACIDITY		LOCATION
	mg/l	mg/l	NTU	mg/l	mg/l Fe		mg/l $CaCO_3$ eq.		
TIME DATE - CLOCK									1
21 DEC 79 3PM	40.9		13	12	3.6	4.2	5.6	176	2
	3.31	0.35	14	26	3.7	4.2	5.6	164	6
	2.20	0.37	15	12	4.1	4.8	13.1	182	2
22 DEC 79 7AM	0.98	0.07	17	16	3.5	4.8	9.0	175	6
	0.36	0.02	13	20	3.8	5.3	7.9	155	2
22 DEC 79 11AM	0.34	–	16	23	3.8	4.9	8.2	168	6
	0.32	–	13	24	3.4	6.1	13.0	181	2
3PM	5.52	–	14	8	3.8	5.1	7.5	165	6
	0.29	–	9	10	3.4	5.8	6.8	180	2
23 DEC 79 7AM	3.01	–	14	7	3.7	4.4	7.5	165	6
	0.39	–	16	12	4.1	4.4	5.6	179	2
23 DEC 79 11AM	0.42	–	14	9	3.3	4.3	9.4	168	6
	0.29	0.06	11	8	3.3	5.2	7.5	178	2
23 DEC 79 3PM	0.46	–	7	13	3.1	4.3	NIL	172	6
	0.29	–	12	7	3.4	4.3	NIL	161	2
24 DEC 79 7AM	0.35	–	10	13	3.3	3.0	NIL	187	6
	0.28	–	13	11	4.2	6.5	12.4	141	2
24 DEC 79 11AM	0.31	–	8	11	3.5	3.1	NIL	171	6
	0.31	–	9	10	3.6	3.0	NIL	464	2
24 DEC 79 3PM	4.94	–	10	8	3.6	3.0	NIL	178	6
	0.31	–	8	11	3.8	5.4	10.7	152	2
25 DEC 79 7AM	50.0	–	10	7	3.4	3.9	NIL	178	6
	0.34	–	10	9	3.6	3.6	NIL	42	2
25 DEC 79 11AM	1.00	–	11	3	3.5	4.6	288	171	6
	0.32	–	11	8	4.0	3.0	NIL	188	2
25 DEC 79 3PM	0.44	0.004	10	5	3.4	3.0	NIL	330	6
	0.33	0.002							

TWO MECHANICAL AERATORS

46 0060

K+E GENERAL DATA • 7 COLUMNS X 40 LINES KEUFFEL & ESSER CO. MADE IN U.S.A.

Test C 3 10 00488

Time Date - Clock	CCl_4 mg/l	CS_2 mg/l	Turbidity NTU	TSS mg/l	Iron mg/l Fe	pH	Alkalinity mg/l $CaCO_3$	Acidity mg/l $CaCO_3$
26 DEC 79 9AM	61.9	2.39	2.1	23	8.5	5.4	16	57
	0.41	0.01	4.0	20	3.7	2.9	NIL	265
	0.76	–	9.7	20	3.5	3.0	NIL	279
	0.51	0.017	9.6	18	3.7	2.9	NIL	270
	0.001	–	37.0	18	3.0	6.6	18	261
26 DEC 79 10AM	61.3	3.93	1.8	9	8.6	5.4	16	35
	0.74	–	10.0	21	3.7	2.0	NIL	288
11AM	63.1	3.41	1.6	8	8.4	5.4	17	53
	0.32	–	10	15	3.8	3.0	NIL	293
1PM	62.4	3.72	1.6	11	9.0	5.6	56	57
	0.75	–	9.2	10	3.8	3.0	NIL	323
	0.12	–	36.0	16	3.0	6.5	308	57
3PM	63.1	3.61	1.9	13	8.8	5.5	20.5	53
	0.76	–	8.6	14	3.8	2.9	NIL	330
5PM	45.9	–	4.3	5	8.9	2.8	NIL	155
	15.6	–	8.6	22	6.6	5.4	12.0	100
	0.81	–	10.0	10	4.0	3.0	NIL	80
	0.73	–	13.0	11	3.7	5.4	18.8	425
	0.08	–	37.0	6	3.4	5.9	349	85
	2.95	–	10.0	10	5.2	2.8	NIL	120
	0.93	–	8.3	13	4.2	3.3	NIL	70
27 DEC 79 9AM	68.2	–	8.2	2	8.4	6.1	20	50
	0.73	–	11.0	11	4.6	6.6	22	470
	0.85	–	8.4	11	4.2	2.9	NIL	110
	0.82	–	11.5	22	4.6	3.0	NIL	190
	0.034	–	49	9	3.6	9.3	368	
3PM	0.87	–	7.2	4	4.6	2.9	NIL	122
7PM	2.13	–	4.6	2	4.4	3.8	NIL	60
	0.85	–	6.5	12	4.6	2.8	NIL	125
28 DEC 79 3AM	0.63	–	–	–	–	–	–	–
	0.96	–	–	–	–	–	–	–
	0.78	–	–	–	–	–	–	–
6AM	0.66	–	–	–	–	–	–	–
	0.81	–	–		–			
9AM	61.1	–	4.4	3	8.7	5.9	26	50
	0.635	–	9.1	4	4.5	2.9	NIL	110
	0.82	–	7.4	3	4.0	3.0	NIL	115
	0.83	–	9.7	6	4.8	3.0	NIL	100
	0.037	–	8.3	15	3.1	12.0	1360	NIL
29 DEC 79 7AM	63.3	–	0.3	30	8.1	5.8	16.7	63
	8.3	–	6.2	6	5.7	3.4	NIL	49
	0.67	–	4.1	2	4.8	3.0	NIL	97
11AM	53.9	–	0.3	33	8.8	5.3	16.3	105
	5.46	–	5.4	2	5.5	3.3	NIL	53
	0.68	–	4.1	2	4.7	3.0	NIL	98
3PM	52.9	–	0.1	39	7.0	5.3	17.0	83
	4.06	–	4.7	5	5.3	3.5	NIL	47
	0.64	–	8.8	4	5.0	3.0	NIL	95
30 DEC 79 7AM	62.6	–	1.5	10	8.9	6.3	16.3	75
	5.22	–	6.3	32	4.5	4.1	7.8	28
	0.65	–	2.0	9	3.9	3.3	NIL	58
11AM	63.5	–	1.6	17	9.2	5.3	17.8	79
	5.74	–	7.5	52	5.3	4.0	5.3	
	0.67	–	4.0	9	4.2	3.3	NIL	[illegible]
3PM	62.9	–	1.6	27	9.5	5.3	16.7	78
	5.92	0.012	6.6	46	6.2	3.9	5.7	34
	0.67	0.012	4.8	9	4.3	3.3	NIL	52

Mechanical Aerators

K·E GENERAL DATA • 9 COLUMNS X 40 LINES
KEUFFEL & ESSER CO. MADE IN U.S.A.

TEST D 3 10 00437

	CCl_4 mg/l					
LOCATION	2		5			
31 DEC 79	0.332		0.54			
1 JAN 80	0.406		0.281			
2	0.307		0.079			
3	0.526		0.014			
4	0.216		0.059			
5	0.347		0.102			
6	0.514		0.110			
7	0.076		0.064			
8	0.069		0.062			
9			0.002			
10			0.002			
11 JAN 80			0.001			
AVERAGE	0.450		0.079	7 sets of matched data		

SEE FIGURE 2 FOR detention time estimate

K+E GENERAL DATA • 5 COLUMNS X 40 LINES KEUFFEL & ESSER CO. 46 0060

TEST E 3 10 00458

	CCl_4	CS_2	TURBIDITY	pH	LOCATION
7 JAN 80 10 AM	0.103	0.293	12.5	7.0	1
	0.054	–	7.9	3.3	3
	0.056	0.014	7.6	3.3	5
2PM	0.016	–	7.6	7.3	1
	0.013	–	7.4	3.5	3
	0.013	–	7.9	3.5	5
4PM	–	–	7.2	6.8	1
	–	–	10.0	3.0	3
	–	–	11.5	2.8	5
8PM	0.002	–	9.7	6.8	1
	–		10.0	3.6	3
	0.002		9.0	3.0	5
12PM	–	–	8.0	7.0	1
	–	–	11.0	3.0	3
	–	–	11.5	2.0	5
8 JAN 80 7AM	0.139	–	8.0	7.2	1
	–	–	11.0	3.0	3
	0.003	0.041	11.5	3.0	5
8PM	0.039	–	1.2	7.3	1
	0.001	–	5.6	3.4	3
	0.001	–	6.5	3.4	5
1PM	0.014	–	1.4	7.5	1
	0.001	–	6.3	3.7	3
	0.001	0.013	6.4	3.7	5
4PM	–	–	1.6	7.4	1
	–	–	6.5	3.2	5
8PM	0.004	–	1.5	9.3	1
	0.02	–	9.0	7.2	5
12PM	–	–	1.3	9.3	1
	–	–	7.8	3.4	5
9 JAN 80 4AM	0.004	–	1.4	8.8	1
	0.002	–	11.5	3.3	5

2 MECHANICAL AERATORS.

① Represents Production Plant EFFLUENT IN THIS TEST ONLY

3 10 00439

ATTACHMENT 2

NOTES ON POTENTIAL REMEDIAL ACTIONS

3 10 00440

8/23/83

Notes on Potential Remedial Action Technology
For CMA's Solidwaste Work Shop

I. Groundwater Interceptor System (South Eastern U.S.)

Because of leaks and spills over the years, the groundwater beneath this plant had become contaminated with fairly high concentrations of volatile organics. After an extensive groundwater study and pilot testing, a groundwater interceptor and treatment system was designed. Two rather significant groundwater parameters came to light during the study which had a bearing on the overall design. These were low pH (3.6 to 6.2) and high dissolved iron (10 to 15 ppm). It became apparent that the most cost effective method of organic removal was some sort of aeration. Any aeration would however oxidize the dissolved iron to insoluble ferric hydroxide and further reduce the pH. This eliminated the possibility of using a packed bed air stripper and groundwater reinjection.

From the hydrogeologic investigation, it was determined that three (3) interceptor wells located in a line 300 ft. apart and pumping at 500 GPM each would form a depression to intercept the contaminated groundwater. It was also determined that by sparging the water through spray nozzles, about 80 to 90% of the volatile organics would be driven off. To meet surface water discharge limits, organic removals of 99.8% were necessary and the pH of the effluent had to be between 6 and 9. Total suspended solids were limited to 30 ppm.

A rectangular shaped pond with a capacity of 3,200,000 gal. was installed. Because of space limitations the pond was located some 3,600 ft from the interceptor wells. The well pump headers were connected to a 12 in. PVC pipe which terminated at the pond by a spray header with (12) - 2 in. spray nozzles.

In order to achieve better organic removals, 8 floating mechanical aerators were installed and a partial baffle used to limit back-mixing. A quiescent zone near the pond's effluent end allowed for settling of the ferric hydroxide.

The pH was controlled most uniquely with a dual head metering pump feeding 50% caustic directly into the 12 inch pipe line near the well pump end and just upstream of a static mixer. A small pump was used to continuously take samples from the pond and pump it through a pH measuring assembly which sent a set point signal to a pH controller back near the well pumps. This controller compared the pH after caustic addition with the set point and adjusted the metering pump accordingly. A rangeability of 1500 to 1 was deemed necessary so the metering pump was designed with automatic stroke adjust on each head and SCR variable speed control on the pump motor. With a 4 to 20 MA DC input control signal, the pump output flow ranges from 0.0003 to 0.45 GPM.

The treated effluent was collected by a flume connected to a sump outside the pond. A continuous sampler was placed in the line between the sump and the river. Flow was by gravity.

The entire system has been in operation for almost 3 years. The total installed cost was about $2,000,000 and the operating cost is about $60,000 per year. Thus far, the concentration of organic contaminants in the groundwater have been reduced by more than 50%. Concentrations are starting to level off and there is no telling how long it will take to adequately clean the aquifier.

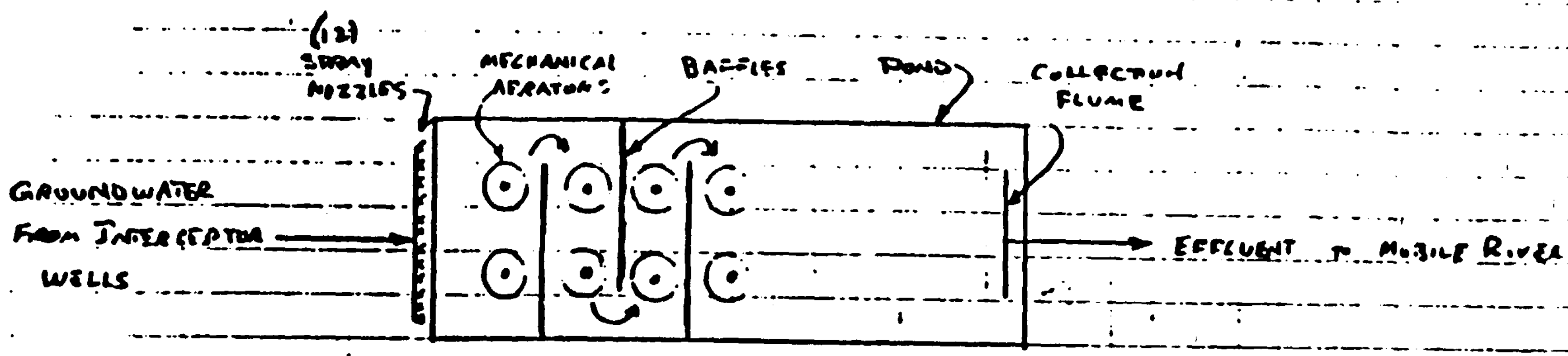
3 10 00442

ATTACHMENT 3

SCHEMATIC OF AERATION SYSTEM

3 10 00443

GROUNDWATER IMPROVEMENT TREATMENT SYSTEM - LEMOYNE, ALA.



	FLOW GAM	CCl_4 PPM	CS_2 PPM	% REDUCTION (NOZZLES)	% REDUCTION AERATORS (EA. SET)	TOTAL % REDUCTION BASED ON CCl_4	CCl_4 PPM	CS_2 PPM
DESIGN	1500	60	30	90	90/90/90/90	99.9	0.05	0.05
JAN 1981	1330	22.8	5	82	75/75/75/75	99.6	.085	.027
JAN 1983	1070	6.5	1.9	?	"	99.5	.033	.004
JAN 1985	1300	4.0	1.3	60 (ESTM)	"		< .05	< .05

WMC 10/24/

3 10 00444

APPENDIX XXIV
SUMMARY TABLE OF MONTHLY THIOCARBAMATE DISCHARGE ANALYSIS, TABLE 24-1

TABLE 24-1

SUMMARY TABLE OF MONTHLY THIOCARBAMATE DISCHARGE ANALYSIS

(THIOCARBAMATE CONCENTRATIONS IN POUNDS/DAY)

	1984			1985			1986			1987		
Month	Lemoyne	Cold Creek	Total	Lemoyne	Cold Creek	Total	Lemoyne	Cold Creek	Total	Lemoyne	Cold Creek	Total
January	N/A	N/A	N/A	0.15	0.07	0.22	0.06	2.54	2.60	0.14	2.51	2.65
February	N/A	N/A	N/A	0.17	0.50	0.67	0.33	0.43	0.76	0.10	0.54	0.64
March	N/A	N/A	N/A	0.14	0.99	1.13	0.15	0.30	0.45	0.16	0.49	0.65
April	0.46	<0.10	<0.56	0.10	0.02	0.12	0.16	0.25	0.41	0.00	1.10	1.10
May	0.40	0.10	0.50	N/A	0.05	0.05+	0.27	<0.01	0.27	0.07	0.61	0.68
June	0.29	0.14	0.43	0.11	0.23	0.34	0.01	0.16	0.17	0.26	1.58	1.84
July	0.68	0.64	1.32	0.10	4.00	4.10	0.07	0.21	0.28	0.20	1.60	1.80
August	0.30	0.31	0.61	0.12	1.44	1.56	0.01	0.38	0.39	0.09	0.12	0.21
September	0.29	0.02	0.31	0.09	0.71	0.80	0.16	0.08	0.24	0.10	1.05	1.15
October	0.39	0.10	0.49	0.10	0.27	0.37	0.09	0.11	0.20	0.20	0.16	0.36
November	0.11	0.06	0.17	0.16	0.70	0.86	0.89	0.16	1.05	0.28	0.03	0.31
December	N/A	0.40	0.40+	0.16	0.02	0.18	0.07	0.62	0.69	N/A	N/A	N/A

3 10 00445

APPENDIX XXV

EXPLANATION OF WHY THE MERCURY LOCATED IN THE COLD CREEK SWAMP IS IN THE INORGANIC MERCURY SULFIDE FORM

APPENDIX XXV

EXPLANATION OF WHY THE MERCURY LOCATED IN THE COLD CREEK SWAMP IS IN THE INORGANIC MERCURY SULFIDE FORM

Stauffer Chemical Company started up a plant to produce carbon tetrachloride at the LeMoyne site in 1964. This plant is still in operation today. The following year, a mercury-cell caustic-chlorine plant was started up at the LeMoyne site. Wastewater from both plants was discharged into a natural stream which flows across the property from the southwest to the northeast and then discharges into the Cold Creek Swamp. Waters from the natural stream combine with waters from Cold Creek, Sisters Creek and other natural drainage to recharge the swamp, which not only recharges the groundwater, but also discharges to the Mobile River.

The discharge from the carbon tetrachloride plant contained sulfides formed in the final stages of sulfur purification. The chemical reaction equations for the process are as follows:

1) $3Cl_2 + CS_2 \dashrightarrow CCl_4 + S_2Cl_2$
2) $2S_2Cl_2 + CS_2 \dashrightarrow CCl_4 + 3S_2$

The recovered sulfur is contaminated with a small amount of S_2Cl_2, which is then removed in a hot water wash process producing the sulfide contaminated wastewater.

This wastewater stream was discharged into the natural drainage creek upstream of the chlorine plant wastewater discharge. When the mercury-laden chlorine plant wastewater entered the stream, the mercury immediately reacted with the sulfides, producing the insoluble mercury sulfide, which was then carried into the Cold Creek Swamp prior to precipitation onto the swamp bottom. This practice was changed somewhat in 1970 when the chlorine plant wastewater treatment system was installed to react the mercury with sodium hydrosulfide and settle/filter the mercury sulfide prior to discharge of the wastewater into the natural creek.

In 1974, all discharges to the natural creek were stopped, and a plant-wide system, including effluent from the Cold Creek plant, was installed to transport the effluent to the river through a pipeline under provisions of an NPDES permit.

The mercury sulfide that settled on the swamp bottom is essentially immobile due to the extremely low solubility of mercury sulfide in water and the numerous dams between the plant and the river (natural growth and beaver dams), which tend to prevent washing of the swamp bottom as the result of heavy rain runoff.

The ground-water wells in the area were becoming increasingly contaminated with chlorides from swamp infiltration prior to 1974. Since that time, the chloride concentrations have been dropping due to the plant effluent (high in chlorides) being transported through a pipeline to the river instead of being discharged into the swamp. If the mercury had been in a soluble form, it too would have shown up in the plant water and monitoring wells. This has not been the case.

3 10 00449

APPENDIX XXVI

PLANT FACILITIES

INFORMATION AND DRAWINGS

APPENDIX XXVI
PLANT FACILITIES INFORMATION AND DRAWINGS

Detailed graphic depictions of eight plant facilities (in pockets), thē new carbon tetrachloride wastewater treatment pond, and the LeMoyne acid plant WWT pond are included in this appendix. The information contained in these drawings includes a plan view of the facility, one or more cross sections, facility dimensions, liner locations, and all closure aspects such as depth and type of fill, landfill vent localities, and liner coverage. Locations of adjacent monitoring wells are shown in Figure 1-2 in Section 1.2 and Figures 4-2 and 4-3 in Section 4.4 of this report.

As discussed in Section 4.4.2, the stratigraphy across the site is fairly uniform. Therefore, the stratigraphy in the vicinity of the plant facilities, which is of interest to a depth of approximately 20 feet, the maximum depth of any of the facilities, can be summarized as follows. As shown in Table 4-1 in Section 4.4.2, a red or yellow to brown stiff clay unit with a basal sandy clay section that pinches out locally, is present from ground surface to approximately 8 to 22 feet below ground surface. Sand and clay interbeds that grade laterally into sand and the upper unit are present at depths of from approximately 10 to 15 feet to approximately 11 to 74 feet.

The estimated quantities and kinds of wastes placed in these facilities are summarized as follows:

1) Cold Creek North and South Landfills - The exact quantity of wastes placed in these landfills is unknown. The kinds of waste stored in the two Cold Creek landfills include water treatment plant sludge, used sandblast sand, generator coke, incinerator ash, and filter aid waste.
2) LeMoyne Landfill - It is estimated that approximately 11,000 to 12,000 tons of brine mud, plant refuse, and absorption oil were disposed of in this landfill.

3 10 00451

3) Old Chlorine Plant WWT Pond - Approximately 30,000 pounds of mercury sulfide and miscellaneous fill were placed in this pond.

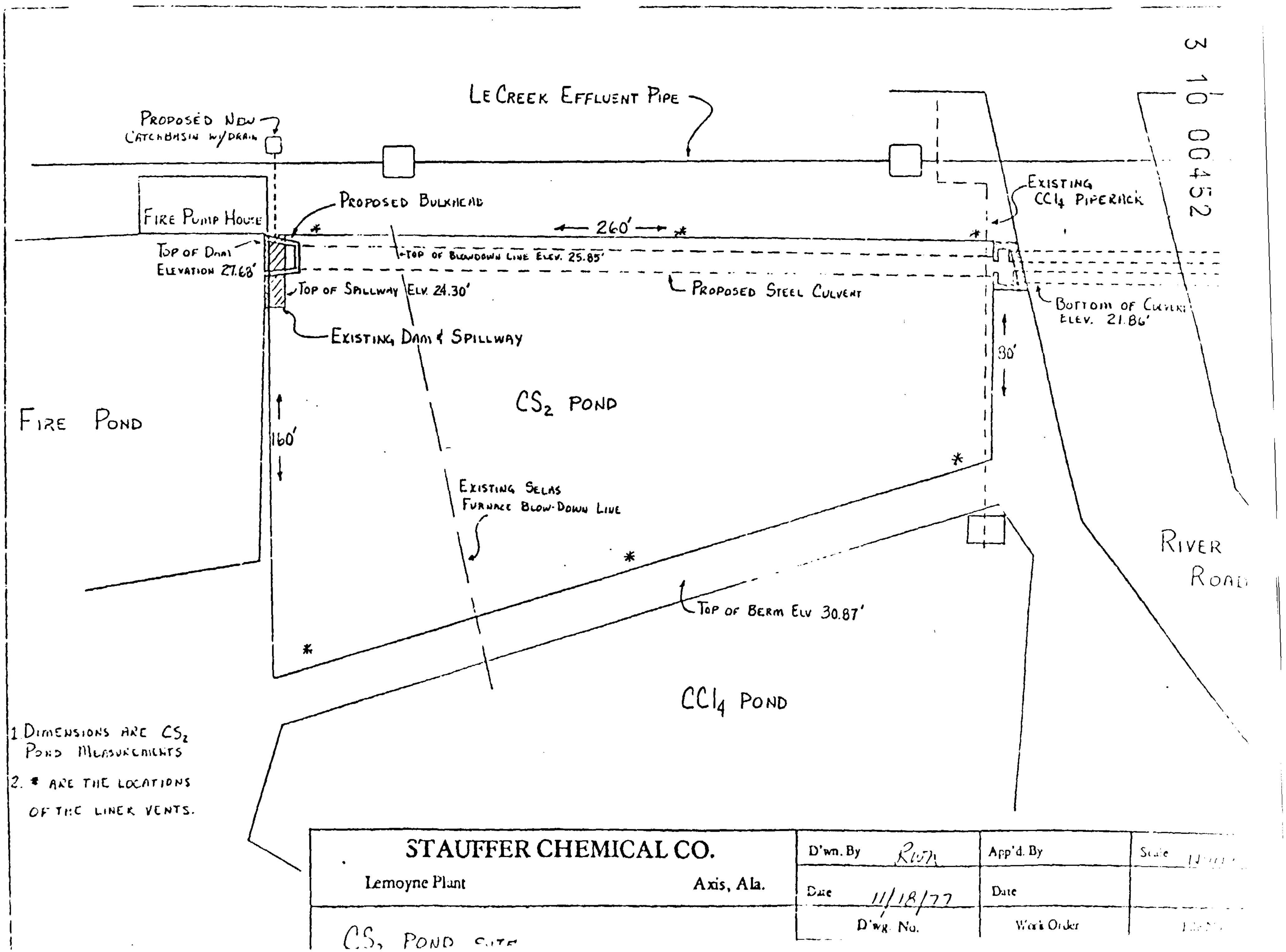
4) Old Brine Mud Pond - Between 4600 and 5500 tons of brine mud were stored in the Old Brine Mud Pond.

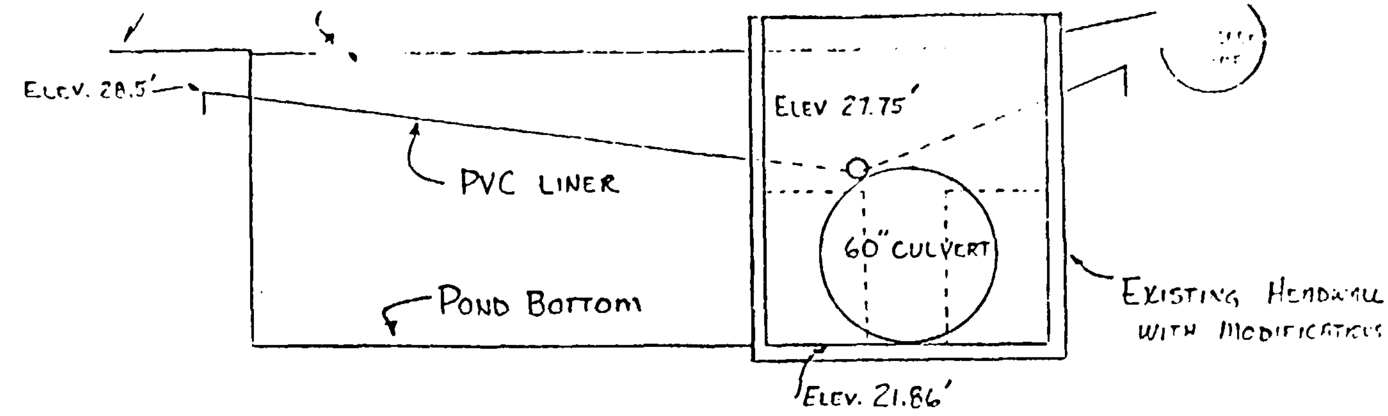
5) Old Carbon Tetrachloride Plant WWT Pond - It is estimated that approximately 1900 cubic yards of sulfur sludge were disposed of in this pond.

6) Old Carbon Disulfide/Carbon Tetrachloride Plant WWT Pond - An estimated 2000 to 3000 cubic yards of sulfur sludge from operation of the carbon disulfide and carbon tetrachloride processes were stored here.

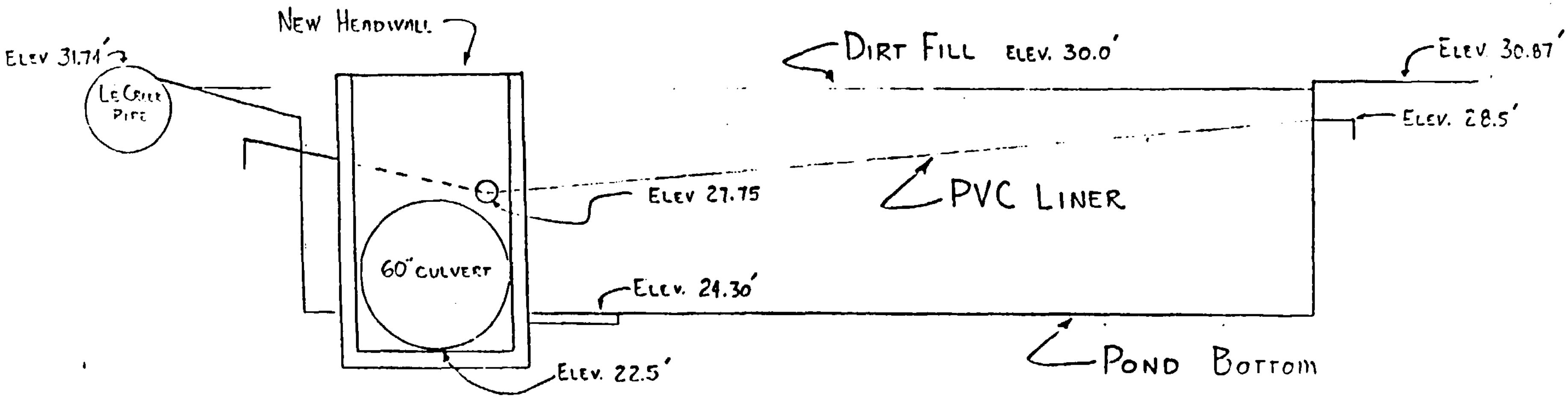
7) New Carbon Tetrachloride WWT Pond - Approximately 300 cubic yards of sulfur sludge from operation of the carbon tetrachloride process are stored in this pond.

8) LeMoyne Acid Plant WWT Pond - Approximately 100 tons of iron sludge from the acid plant are stored in this pond.


3 10 00452
LE CREEK EFFLUENT PIPE
PROPOSED NEW CATCHBASIN W/DRAIN
FIRE PUMP HOUSE
PROPOSED BULKHEAD
260'
TOP OF DAM ELEVATION 27.68'
TOP OF BLOWDOWN LINE ELEV. 25.85'
TOP OF SPILLWAY ELV. 24.30'
PROPOSED STEEL CULVERT
EXISTING DAM & SPILLWAY
EXISTING CCl4 PIPERACK
BOTTOM OF CULVERT ELEV. 21.86'
30'
160'
FIRE POND
CS2 POND
EXISTING SELAS FURNACE BLOW-DOWN LINE
TOP OF BERM ELV 30.87'
RIVER ROAD
CCl4 POND
1. DIMENSIONS ARE CS2 POND MEASUREMENTS
2. * ARE THE LOCATIONS OF THE LINER VENTS.
STAUFFER CHEMICAL CO.
Lemoyne Plant
Axis, Ala.
D'wn. By
App'd. By
Scale
Date 11/18/77
Date
D'wg. No.
Work Order
CS2 POND



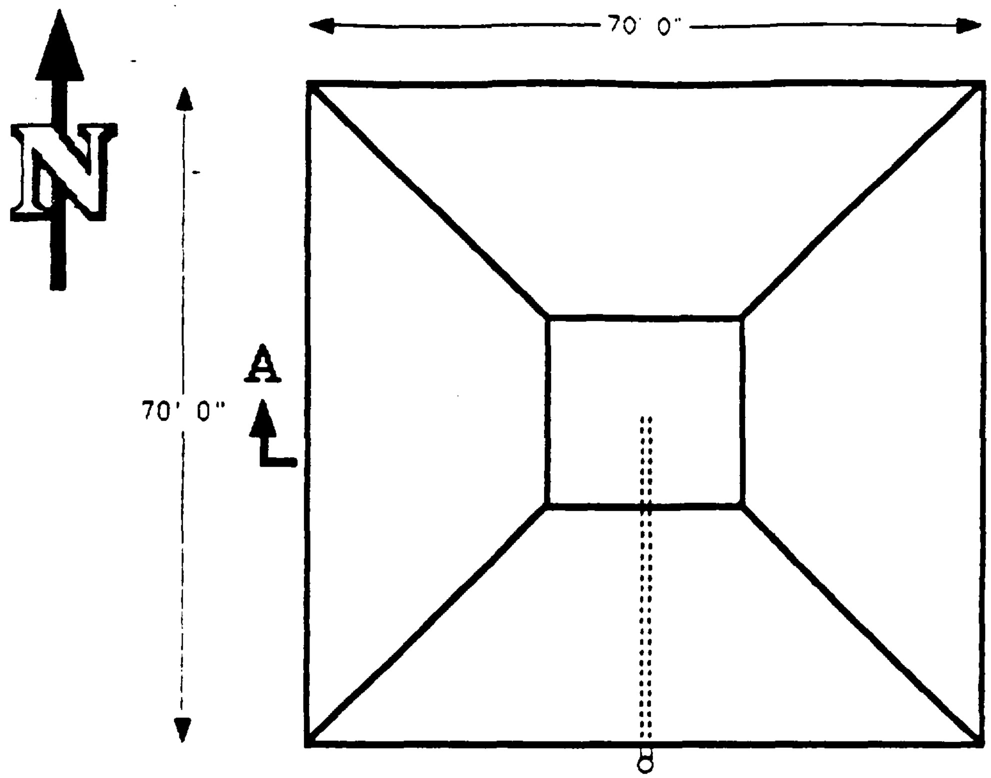
View from River Road through the 60" culvert



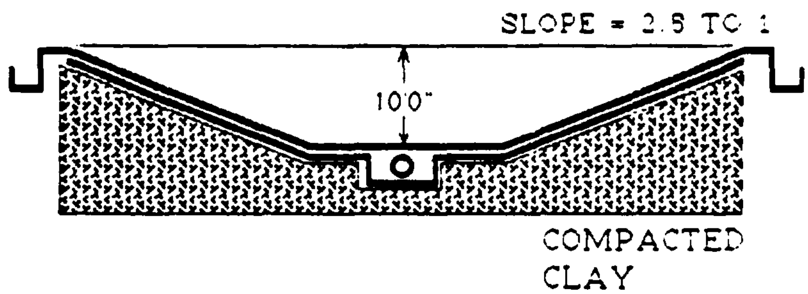
View from Fire Pond through the 60" culvert

STAUFFER CHEMICAL CO. Lemoyne Plant Axis, Ala.	D'wn. By KCM	App'd. By	Scale NONE
	Date 11/15/77	Date	
CS_2 POND LINER & FILL ELEVATIONS	D'wg. No. 2	Work Order	File No.

3 10 00453



PLAN VIEW



A-A SIDE VIEW

TOP LINER:	30 MIL POLYESTER-REINFORCED HYPALON
LEAK DETECTION	POLYETHYLENE SHEETS 6" PVC PIPE

NOTE: DRAWING ASSEMBLED FROM PROJECT FILE AND FIELD MEASUREMENTS

CONSTRUCTED: JUNE, 1977
CAPACITY: 167,000 GAL

Akzo Chemie America
LeMoyne Plant, Axis, Alabama

SULFURIC ACID PLANT EFFLUENT POND - 4EP501

Rev	Date	Description

Dwg. No.	Rev.	Drwn by	Date	Scale
4EP501	0	D. FLACK	1/21/88	1"=20'

3 10 00455

APPENDIX XXVII
GRAPHIC AND DESCRIPTIVE WELL LOGS

2468G G361-740

3 10 00456

GRAPHIC WELL LOGS

2468G G361-740

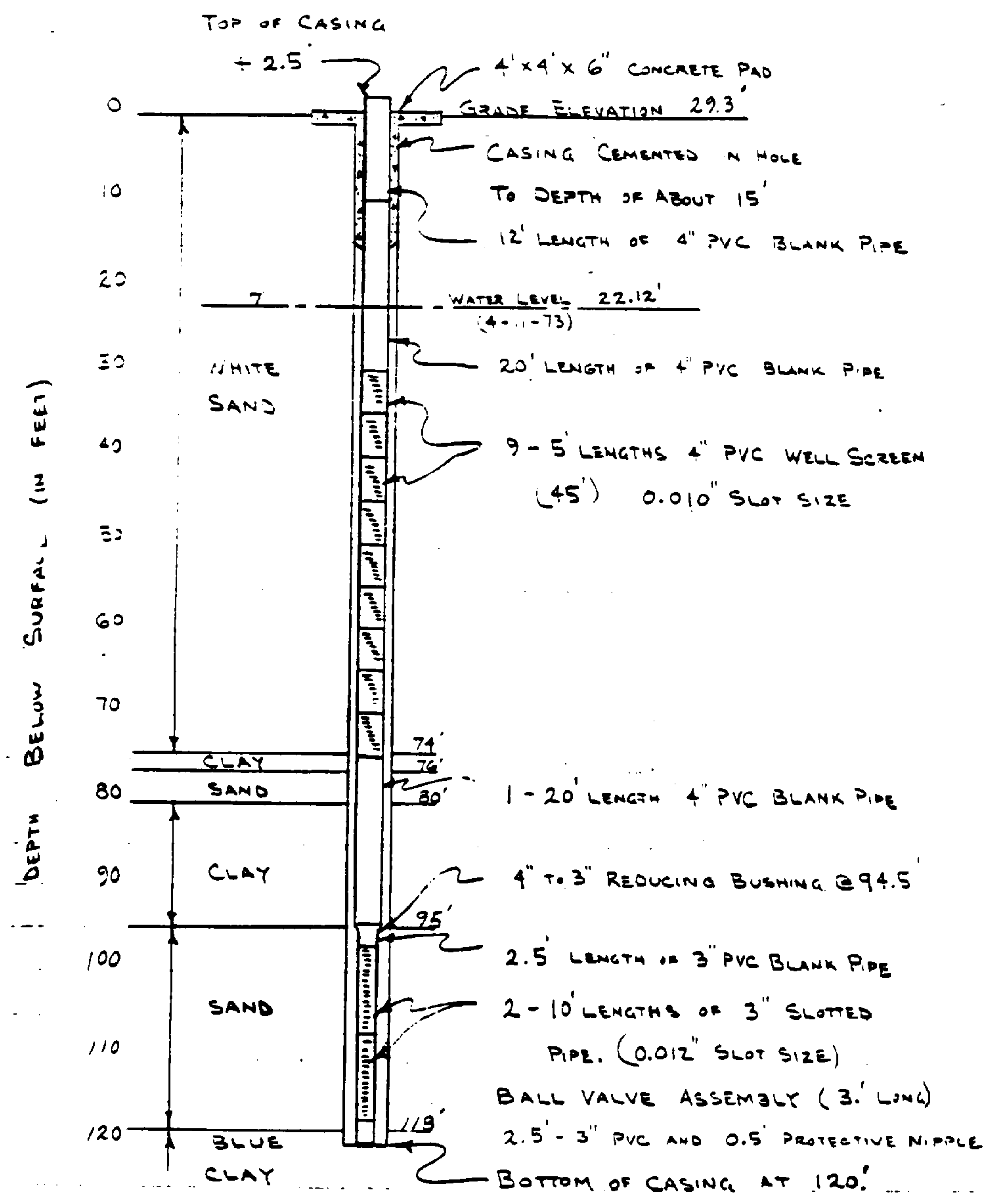
3 10 00457

STAUFFER CHEMICAL COMPANY

GRAPHIC LOG AND CASING DIAGRAM

COLD CREEK PLANT, BUCKS, ALABAMA

EXPLORATORY — BORING O-5



TOTAL DEPTH 120' IN BLUE CLAY

NOTES:

1) FIRST ATTEMPT AT INSTAL... CASING FAILED – STUCK AT ...

2) REAMED HOLE TO 7⅞ FU... LENGTH, USED ABOUT 2 ... ADDITIONAL SACKS OF ...

3) CASING WENT IN, BUT NOT WITHOUT SOME DIFFICULT...

4) INSTALLED AIR LIFT PU... 4/11/73 WITH BOTTOM ... 1½" AIR LINE AT 105' BELOW TOP OF CASING.

5) STARTED PUMPING 4/11/... BUT HAD PROBLEMS WIT... AIR COMPRESSOR

6) CEMENTED CASING 4/1...

W.P.S. 4-18-73

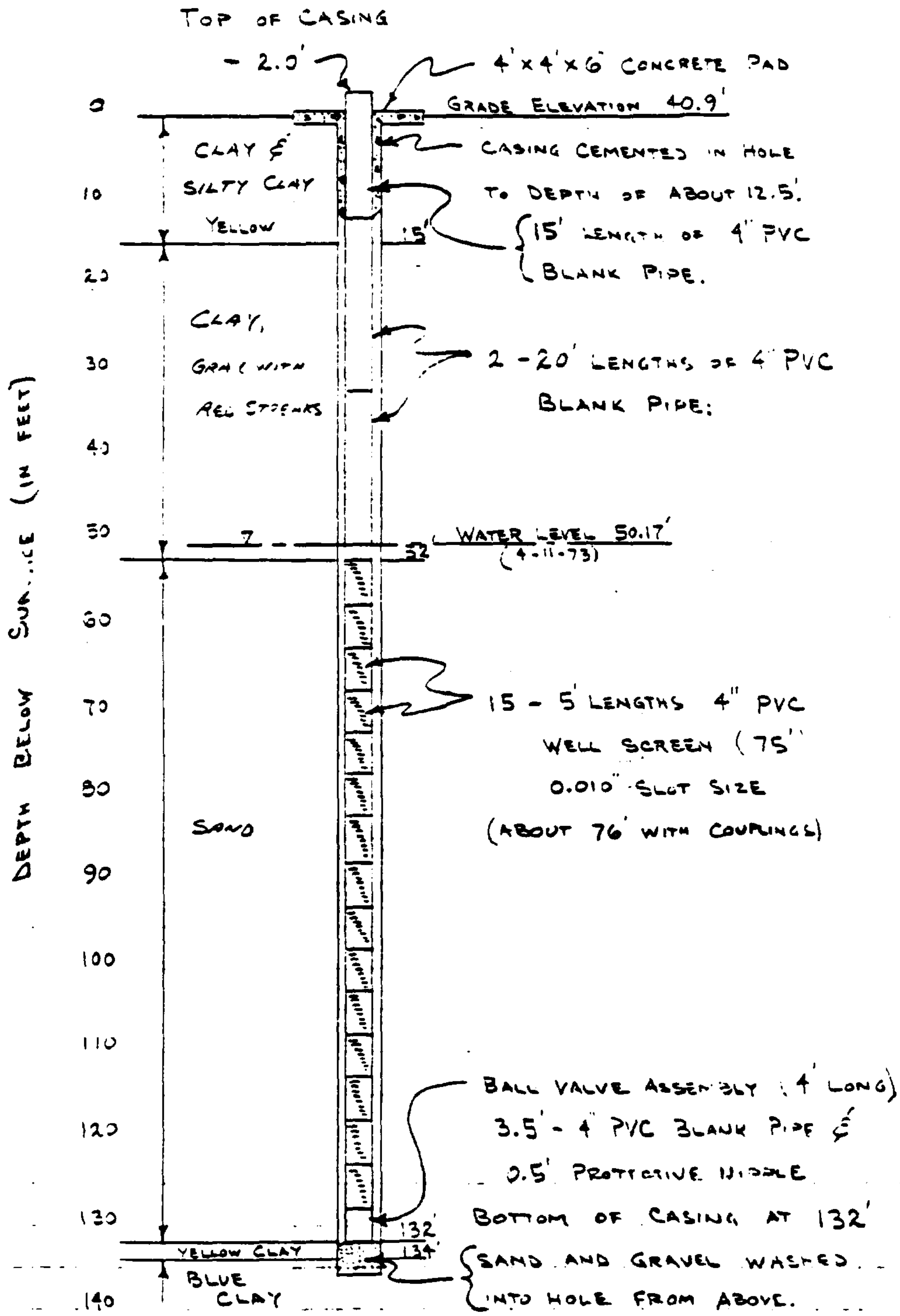
3 10 00458

STAUFFER CHEMICAL COMPANY

GRAPHIC LOG AND CASING DIAGRAM

LEMOYNE PLANT, AXIS ALABAMA

EXPLORATORY BORING 0-6



TOTAL DEPTH 136' IN BLUE CLAY

NOTES:

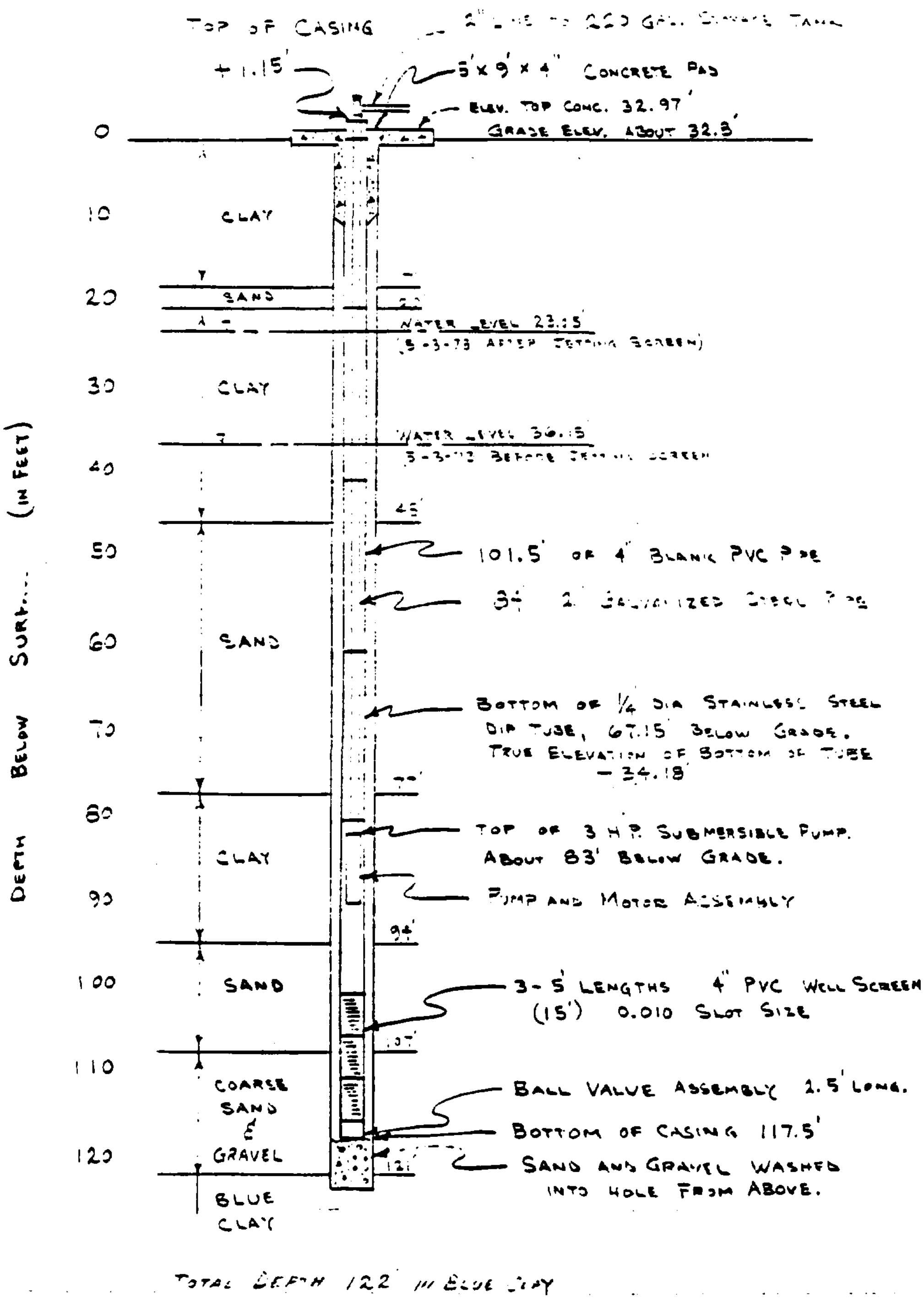
1. INSTALLED CAS[illegible] USING 1½" WASH LINE, BUT DID NOT REAM HOLE
2. CASING STUCK [illegible] ED IN HOLE, HAD TO US WASH LINE FROM THIS POINT TO BOTTOM, REQUI[illegible] 2 ADDITIONAL [illegible]
3. EVEN USING [illegible] LINE COULD NOT GET CASING ALL THE WAY TO BOTTOM. BOTTOM OF CASING ENDED UP ABOUT 4' ABOVE BOTTOM OF DRILLED HOLE.
4. INSTALLED AIR LIFT PUM[P] 4/11/73 WITH BOTTOM OF 1½" AIR LINE 126' BELOW TO[P] OF CASING.
5. CEMENTED CASING 4/13/73
6. PUMPED HOLE ON 4/16/73 AND 4/17/73

W.P.S. 4-19-73

3 10 00459

Stauffer Chemical Company
Graphic Log and Casing Diagram

Cold Creek Plant, Bucks, Alabama
Exploratory Boring O-8



Notes:

1. Had problem with poor cement bond in "Bell-End" full length pipe. Finally had to cut-off bell-ends and use couplings
2. Jetted screen for 1 1/2 hours using 2200 gal. clean water
3. Installed 3 H.P. 220V. single phase submersible pump 5/3/73
4. Installed 1/4 stainless steel dip tube 69' long. 5/3/73
5. Disinfected well using "4TH" calcium hypochlorite (70% avail. chlorine) 5/3/73.
6. Installed sanitary well seal 5/3/73.
7. Placed 3 x 9 x 4" conc. slab around top of casing 5/4/73
8. Started pumping well 1:40 P Friday May 4, 1973.
9. Elev. top of dip tube 34.82'
   Elev. bottom " " -34.18'

W.P.S. 6-1-73

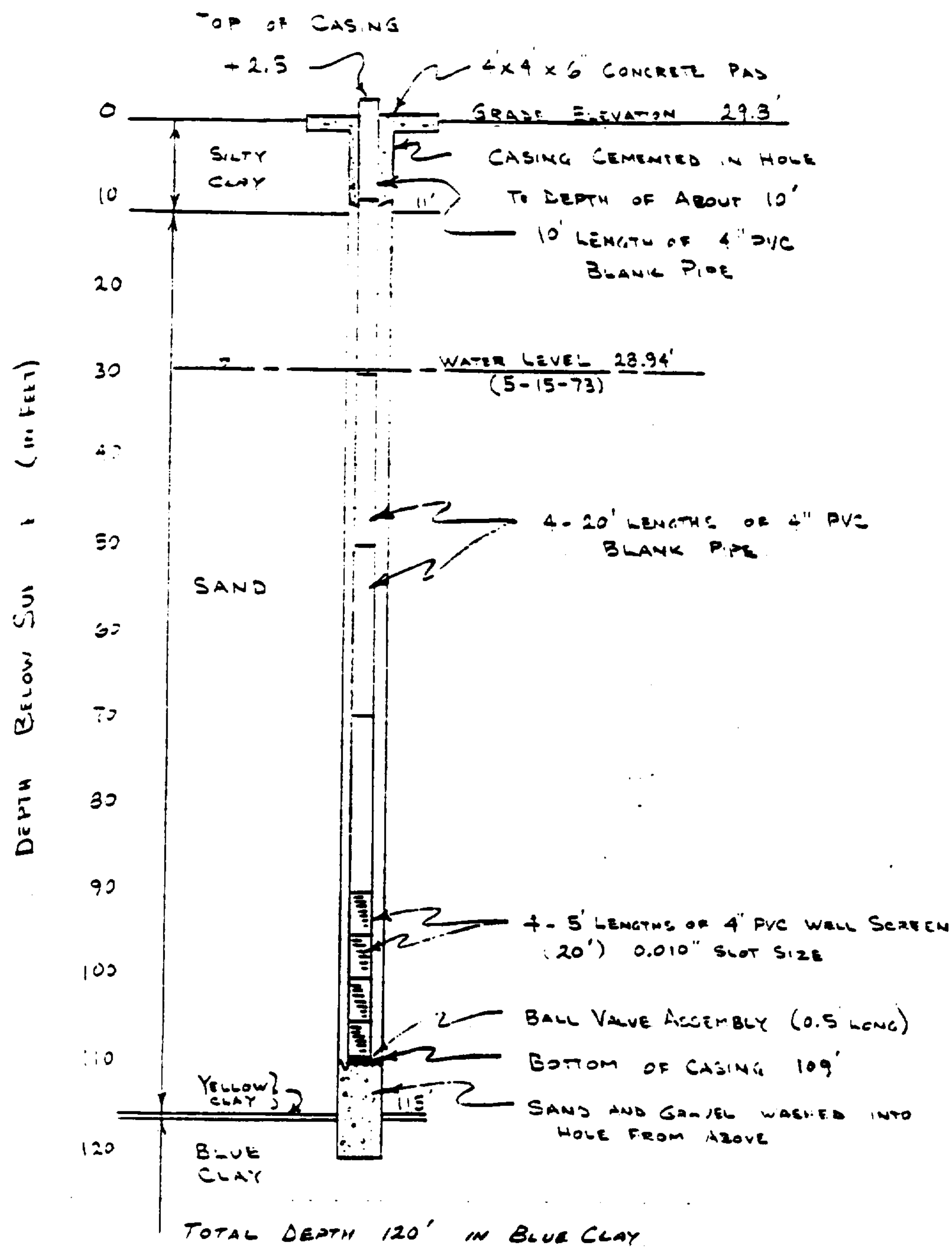
3 10 00460

Stauffer Chemical Company

Graphic Log and Casing Diagram

Cold Creek Plant, Bucks, Alabama

Exploratory Boring O-14



Notes:

1. Reamed Hole to 120' with 7½" Bit. Required 3 Additional 20' Length of line.
2. Could Not Get Casing to Bottom of Hole
3. Jetted Screen Section 2 Hours, Using 3000 + Gal of Water
4. Disinfected Well Using "HTH" Calcium Hypochlor (70% Available Chlorine) May 16, 1973.
5. Installed Air Lift Pump w 1¼" Air Line To 105' Below Top of Casing (May 16, 1973
6. Started Pump 8:45 AM 5/ At 9:45 AM: Flow = 35 GPM, pH ≅ 12, Temp = 21°C, an Water Clear + Colorless
7. At 1:30 PM (5/17/73) Flow = 50 GPM, pH ≅ 11, Water Clear, But Has Slig Yellow-Green Color.
8. Well First Sampled 5/22/
9. Removed Air Lift Pump 6/6/73

W.P.S. 8-30-73

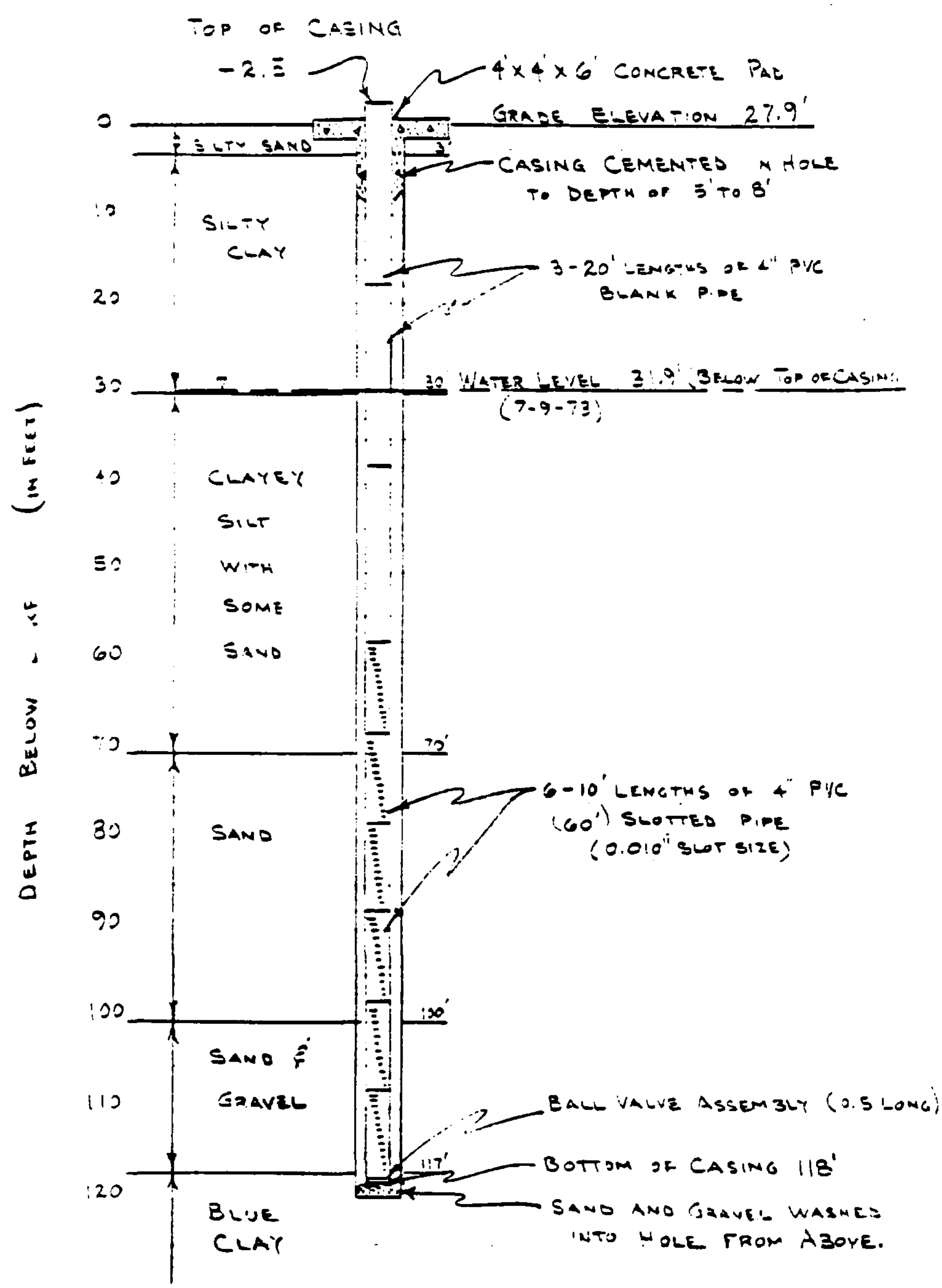
3 10 00461

Stauffer Chemical Company

Graphic Log and Casing Diagram

Cold Creek Plant, Bucks, Alabama

Exploratory Boring O-21



Total Depth 120' in Blue Clay

Notes:

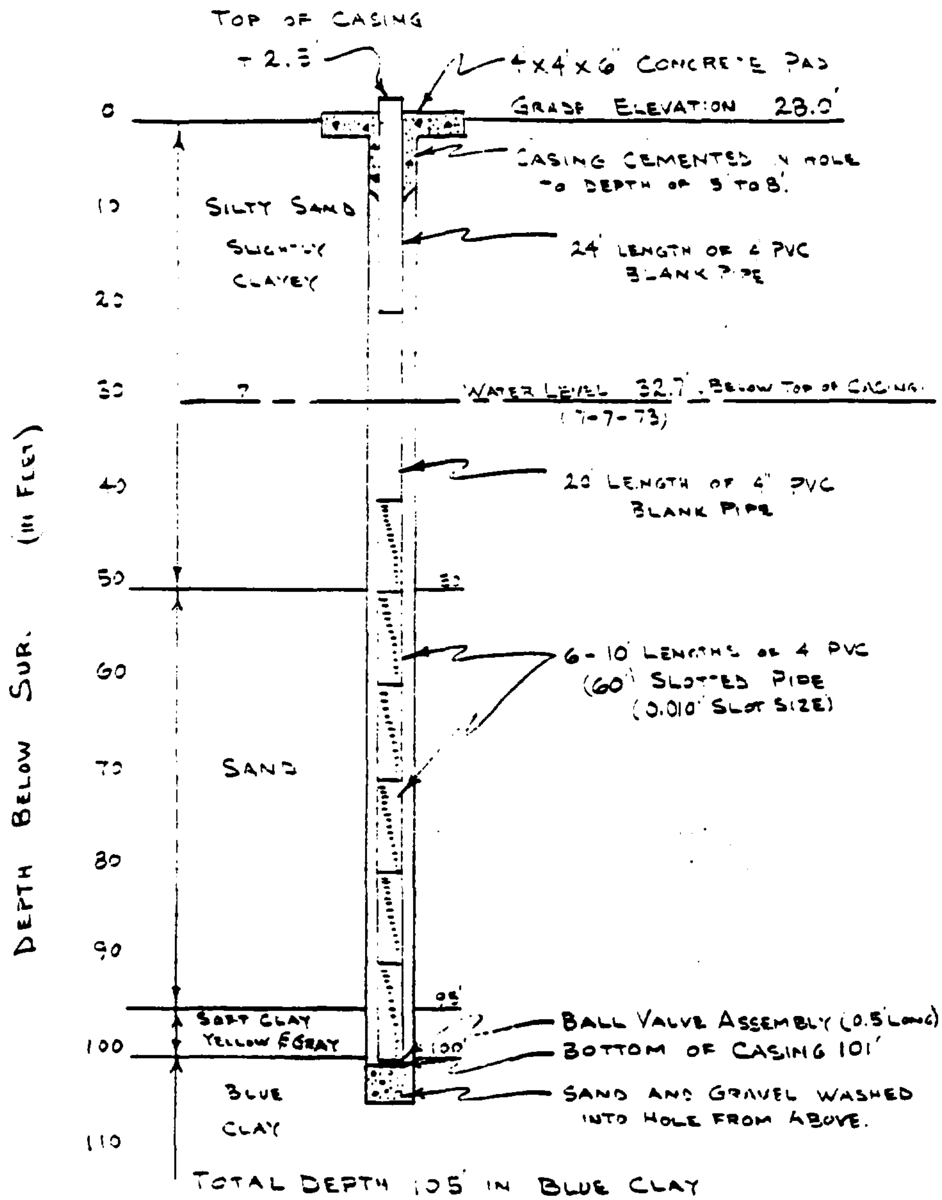
1. Installed ½ H.P. Submersible at 105' Below Surface
2. Well First Sampled 7-3-73
3. Concrete Pad Should Have Been Placed Around Top of Casing Week of July 6th, 1973.
4. Removed ½ H.P. Submersible Pump Week of July 23rd, 1973.

W.P.S. 9-5-73

3 10 00462

STAUFFER CHEMICAL COMPANY
GRAPHIC LOG AND CASING DIAGRAM

LE MOYNE PLANT, AXIS, ALABAMA
EXPLORATORY BORING O-22



NOTES:

1. INSTALLED AIR LIFT PUMP WITH 1½" AIR LINE 95' BELOW TOP OF CASING 7/12/73
2. CONCRETE PAD PLACED AROUND TOP OF CASING 7/10/73
3. WELL FIRST SAMPLED 7/13/73
4. AIR LIFT PUMP REMOVED WEEK OF JULY 23RD, 1973.

W.P.S. 9-5-73

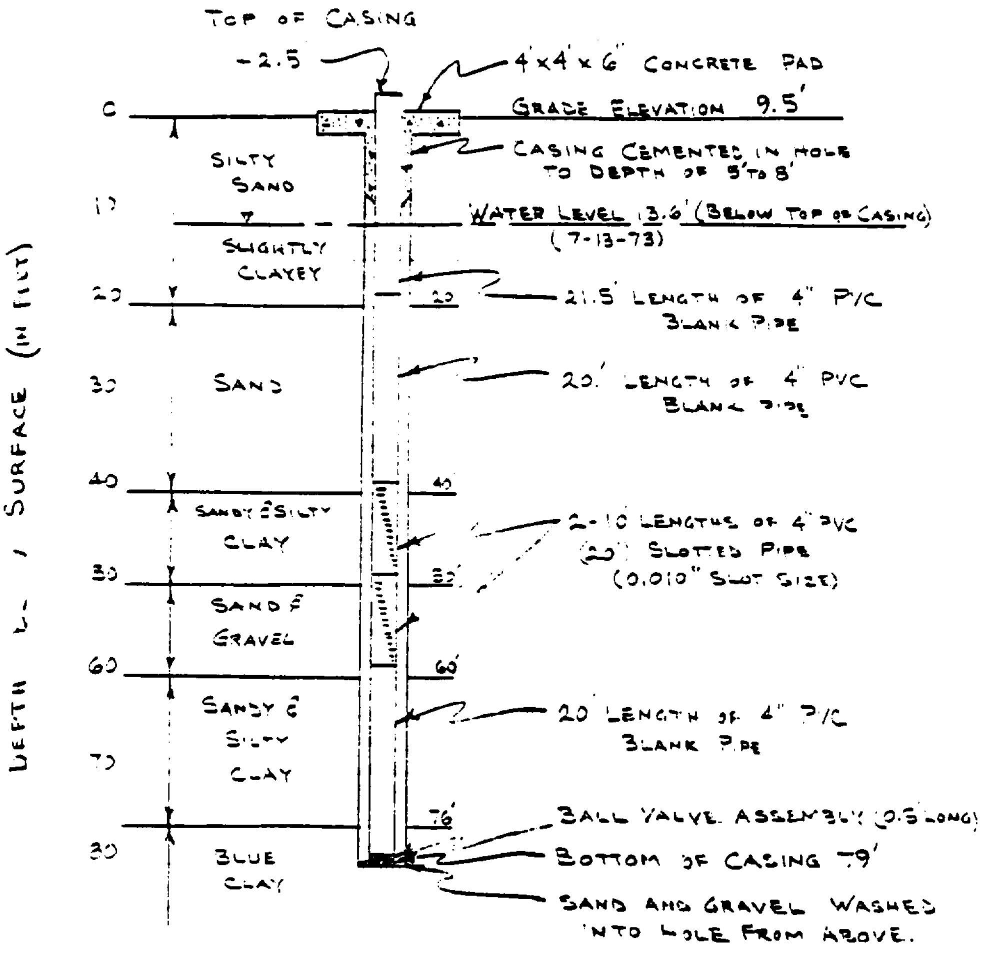
3 10 00463

STAUFFER CHEMICAL COMPANY

GRAPHIC LOG AND CASING DIAGRAM

LE MOYNE PLANT, AXIS, ALABAMA

EXPLORATORY BORING 0-23



TOTAL DEPTH 80' IN BLUE CLAY

NOTES:

1. INSTALLED 1/2 H.P. SUBMERSIBLE AT 63' BELOW TOP OF CASING 7/11/73
2. CONCRETE PAD PLACED AROUND TOP OF CASING 7/12/73
3. WELL FIRST SAMPLED 7/13/73
4. REMOVED SUBMERSIBLE PUMP WEEK OF JULY 23rd 1973.

W.P.S. 9-5-73

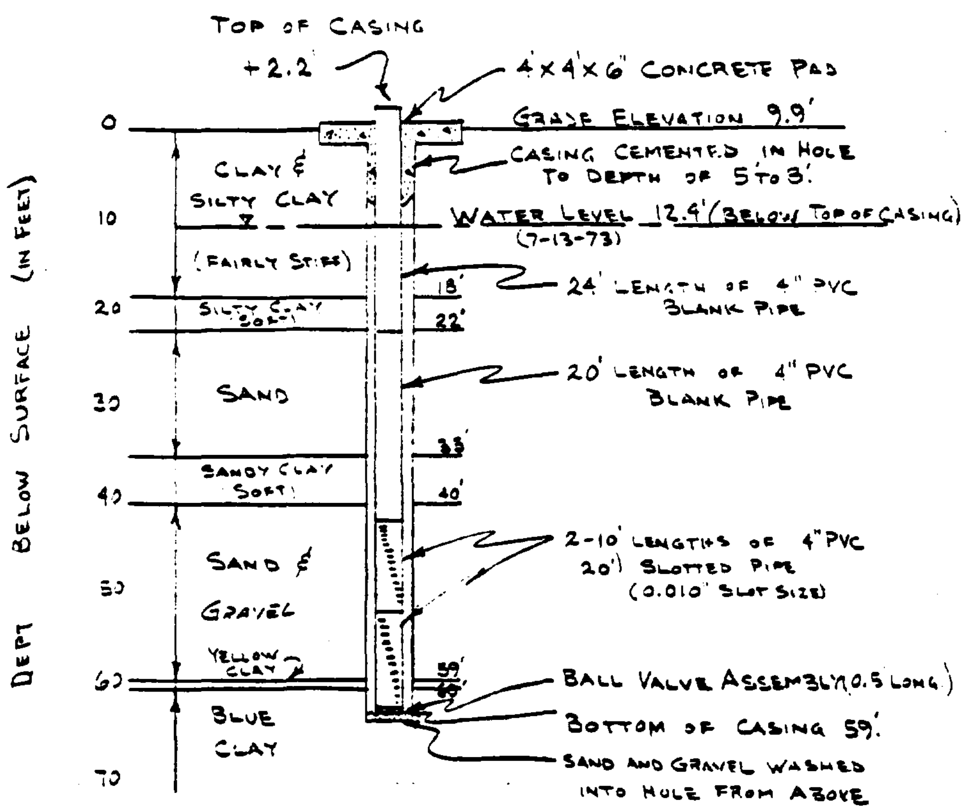
3 10 00464

STAUFFER CHEMICAL COMPANY

GRAPHIC LOG AND CASING DIAGRAM

LE MOYNE PLANT, AXIS, ALABAMA

EXPLORATORY ~~-~~ BORING O-24



TOTAL DEPTH 63' IN BLUE CLAY.

NOTES:

1. WELL DRILLED AS POSSIBLE POTABLE WATER WELL.
2. INSTALLED 1 H.P JET PUMP WITH INTAKE LINE 53' BELOW TOP OF CASING 7/12/73.
3. CONCRETE PAD PLACED AROUND TOP OF CASING 7/12/73.
4. WELL FIRST SAMPLED 7/31/73.

NOTE - WELL O-24 ELEV. FIGURE IS IN ERROR -

CORRECT ELEV. IS GRADE = 13.8 FEET

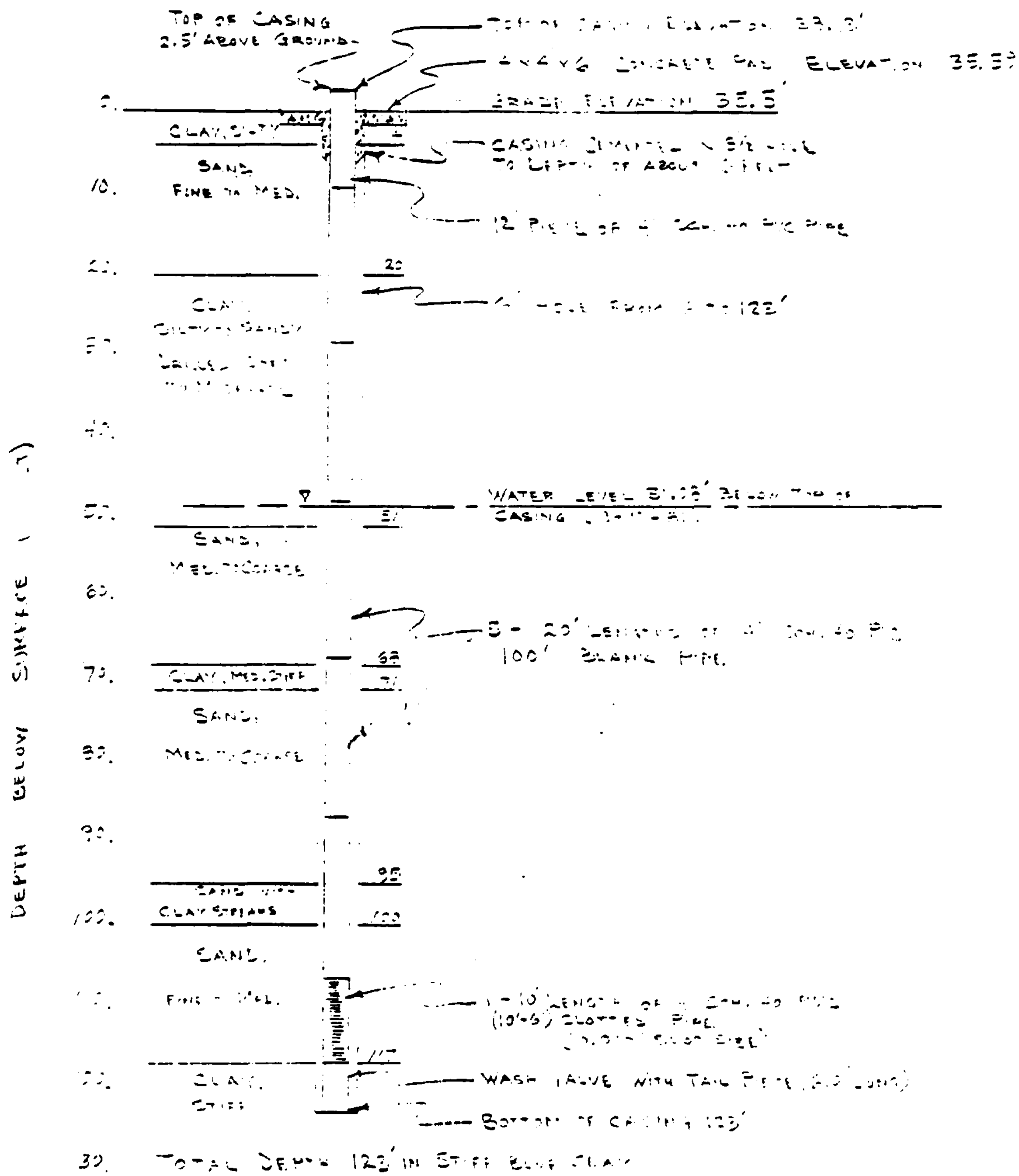
ALSO BOTTOM OF CASING IS SHOWN AS 62-63 FEET LABELED AS 57' THIS IS AN ERROR.

W.P.S. 9-5-73

3 10 00465

STAUFFER CHEMICAL COMPANY
GRAPHIC LOG AND CASING DIAGRAM

LEMOYNE PLANT . AXIS, ALABAMA
MONITOR WELL C-59
UPGRADIENT "NEW" BRINE MUD POND
(DRILLED 3-9-81)

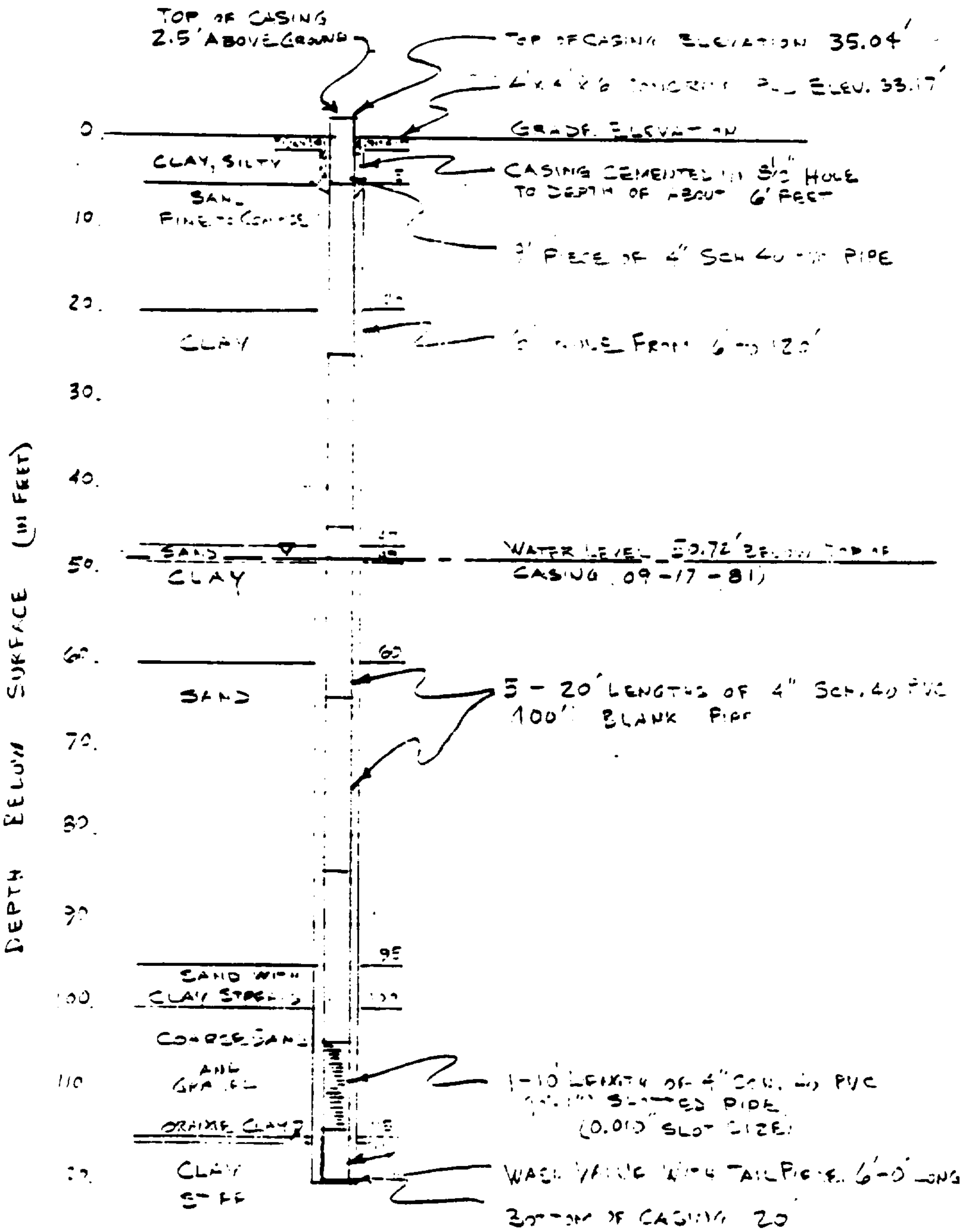


W.P.S. 8-03-81

3 10 00460

STAUFFER CHEMICAL COMPANY
GRAPHIC LOG AND CASING DIAGRAM

LEMOYNE PLANT, AXIS, ALABAMA
MONITOR WELL O-62
DOWNGRADIENT NEW "BRINE MUD POND"
(DRILLED 3-11/12-81)



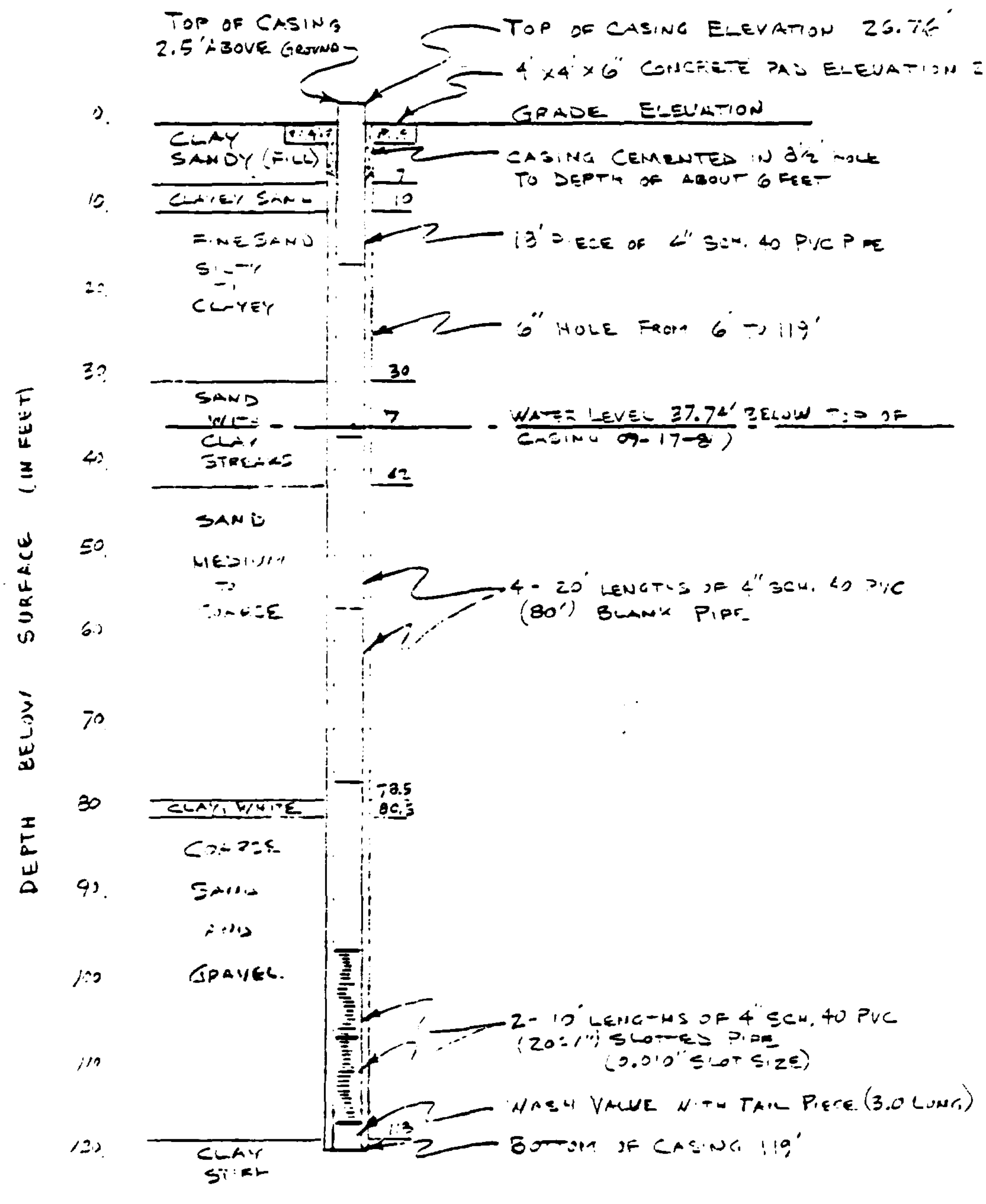
TOTAL DEPTH 120' IN STIFF BLUE CLAY

WPS 8-09-8

3 10 00467

STAUFFER CHEMICAL COMPANY
GRAPHIC LOG AND CASING DIAGRAM

LE MOYNE PLANT, AXIS, ALABAMA
MONITOR WELL O-6B
UPGRADIENT CHLORINE PLANT SURGE POND
(DRILLED 8-25-81)



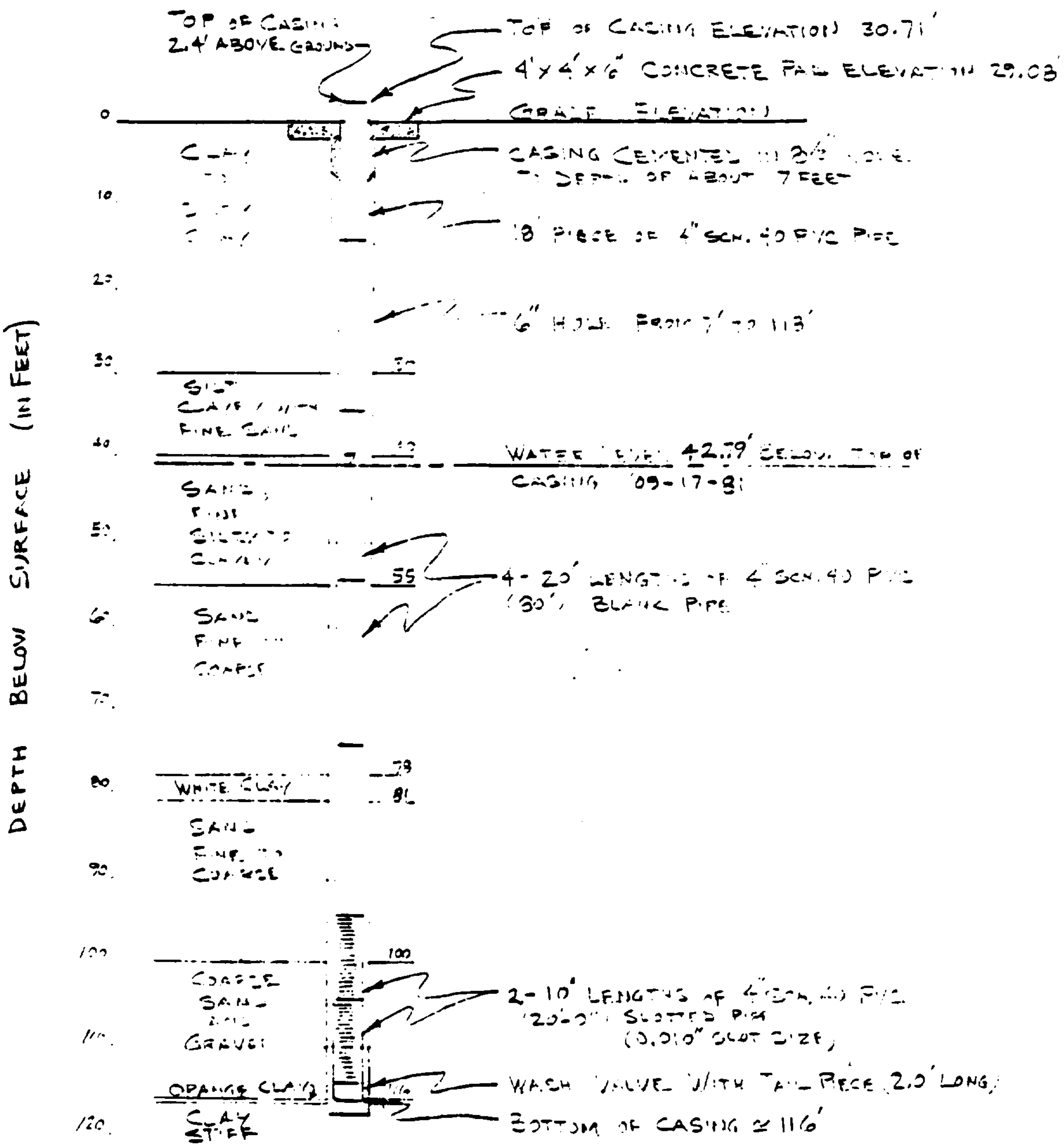
TOTAL DEPTH 119' IN STIFF BLUE CLAY

W.P.S. 8-10-8

3 10 00468

STAUFFER CHEMICAL COMPANY
GRAPHIC LOG AND CASING DIAGRAM

LE MOYNE PLANT, AXIS, ALABAMA
MONITOR WELL O-70
DOWNGRADIENT CHLORINE PLANT SURFACE POND
DRILLED 3-23-81



TOTAL DEPTH 113' IN STIFF BLUE CLAY

W.P.S. 8-11-83

3 10 00469

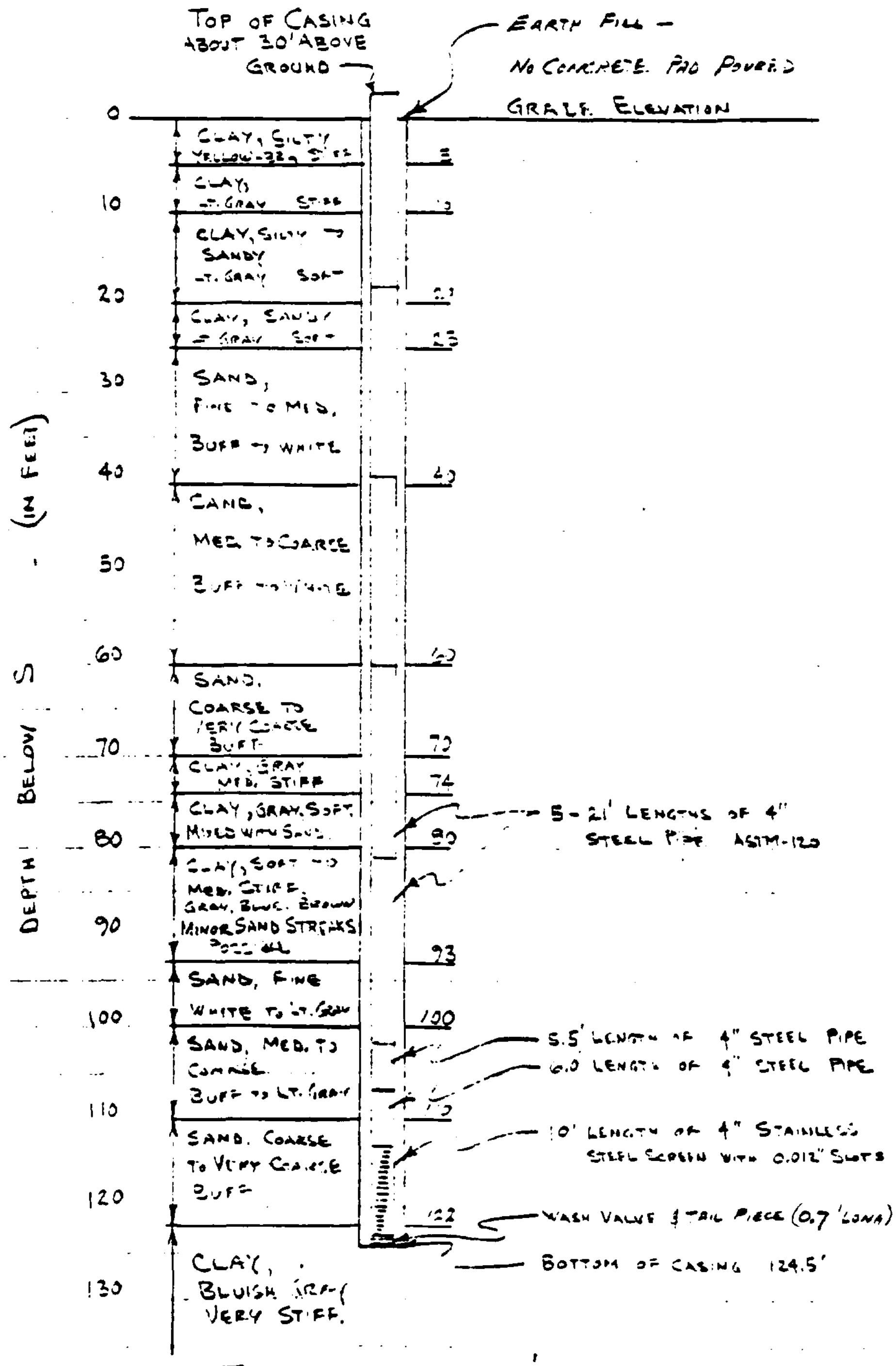
STAUFFER CHEMICAL COMPANY

GRAPHIC LOG AND CASING DIAGRAM

COLD CREEK PLANT, BUCKS, ALABAMA

TEST WELL FOR PROPOSED WATER WELL No. 12

NOTES:



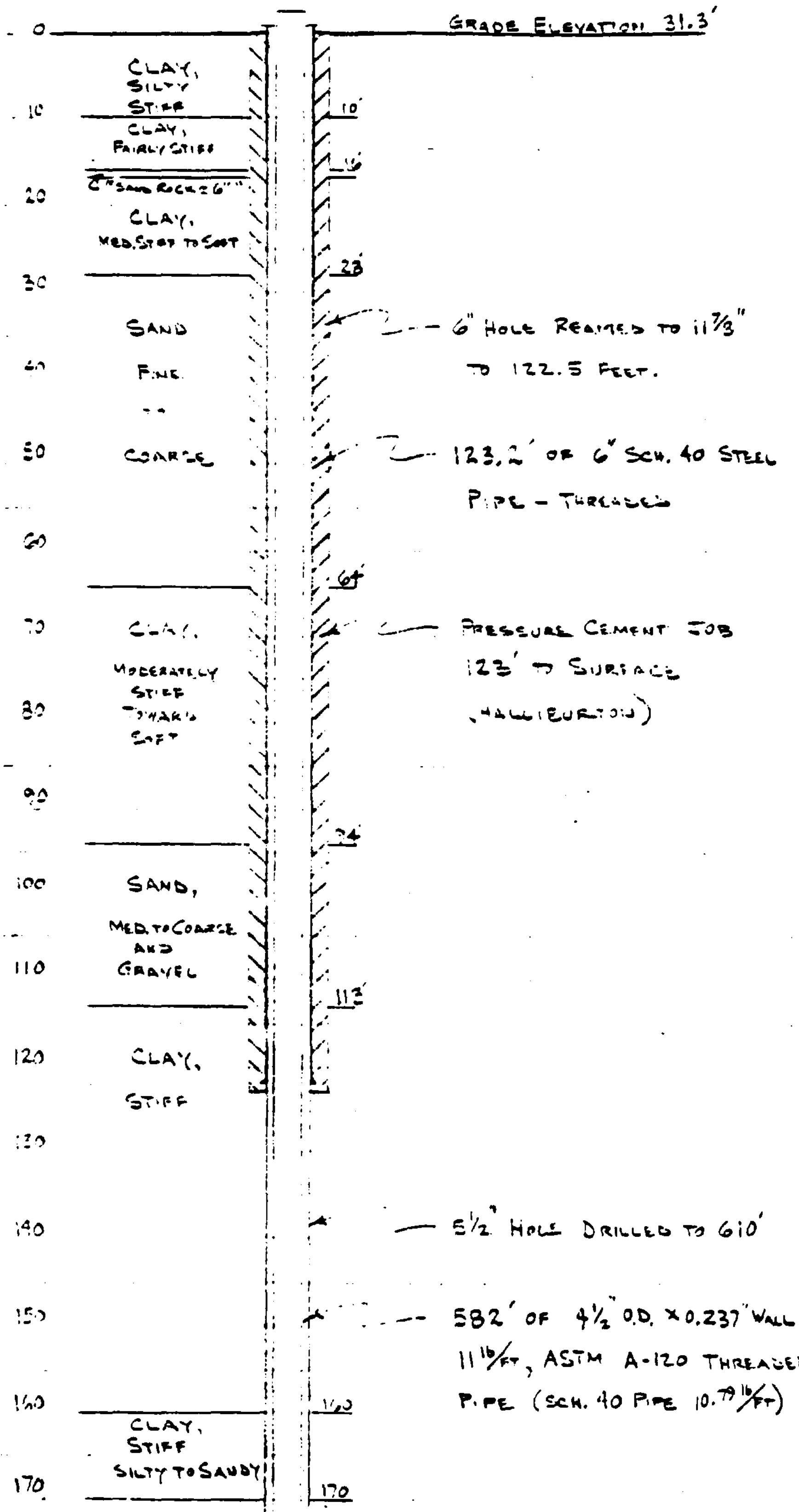
TOTAL DEPTH 124.5' IN BLUE CLAY

W.P.S. 10-25-7

3 10 00470

STAUFFER CHEMICAL COMPANY
GRAPHIC LOG AND CASING DIAGRAM

COLD CREEK PLANT BUCKS, ALABAMA
MONITOR WELL O-28 [FOR INJ. WELL NO.2. - W 2303]



NOTES:

1. DRILLED AND COMPLETED MARCH 20 THROUGH 25, 1975
2. SEE NOTES & REMARKS IN LOG
3. WATER UNDER ARTESIAN PRESSURE FLOW MEASURED AT ABOUT 175 ON MARCH 25, 1975
4. SHUT-IN PRESSURE AT SURFACE ABOUT 15 PSIG ON MARCH 28, 1975
5. STORAGE VOLUME OF CASING 582 FT x 0.66 gal/ft ≅ 385 GAL
6. WELL FIRST SAMPLED 3/23/75
7. SAMPLED FOR MISC. COMPLETE ANALYSIS 6/26/75

WELL O-28 SHEET 1 OF

3 10 00471

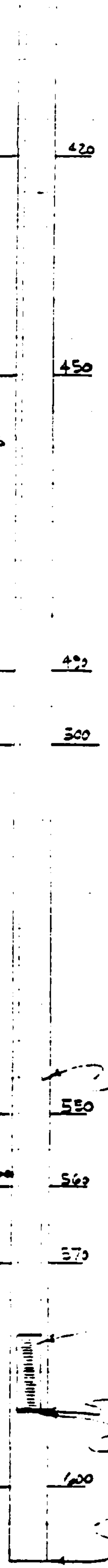
DEPTH BELOW [illegible]CE (IN FEET)

Depth (ft)	Description
180–190	CLAY, SANDY, SOFT
190–200	CLAY
200–210	CLAY, SILTY TO SANDY, SOFT
210–236	SAND, SILTY TO VERY FINE, MIXED WITH CLAY, SOFT
236–266	CLAY, STIFF, SLIGHTLY SANDY
266–270	SAND
270–280	SAND WITH CLAY STREAKS
280–296	CLAY, STIFF
296–300	SAND(?)
300–330	CLAY, STIFF
330–370	CLAY, SOFT
370–	CLAY, VERY STIFF

Depth scale: 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390

3 10 00472

Depth	Description	Depth
400		
410		
420	CLAY, SILTY, TO SLIGHTLY SANDY	420
430		
440		
450	CLAY, WITH STREAKS OF MEDIUM SAND	450
460		
470		
480		
490	CLAY, STIFF	490
500	CLAY, STIFF, WITH SLIGHT AMOUNT OF FINE SAND	500
510		
520		
530		
540		
550	CLAY, MED. STIFF TO SOFT, INCREASE IN FINE SAND	550
560	SAND, FINE TO MED. WITH STREAKS OF CLAY	560
570	SAND, MEDIUM TO COARSE	570
580		
590		
600	SAND, MED. TO COARSE	600
610		



582′ OF 4½″ O.D. x 0.237″ WALL, 11 lb/FT., ASTM A-120 THREADED PIPE (SCH. 40 PIPE 10.79 lb/FT.)

1 - 10′ SECTION, 4″ DIA., 0.010″ SLOT STAINLESS STEEL WELL SCREEN

WASH VALVE WITH TAIL PIECE (0.5′ LONG)

BOTTOM OF CASING 591′

TOTAL DEPTH 610′ IN SAND (BUT EXPECT TO BE ALMOST AT BOTTOM OF THIS SAND INTERVAL)

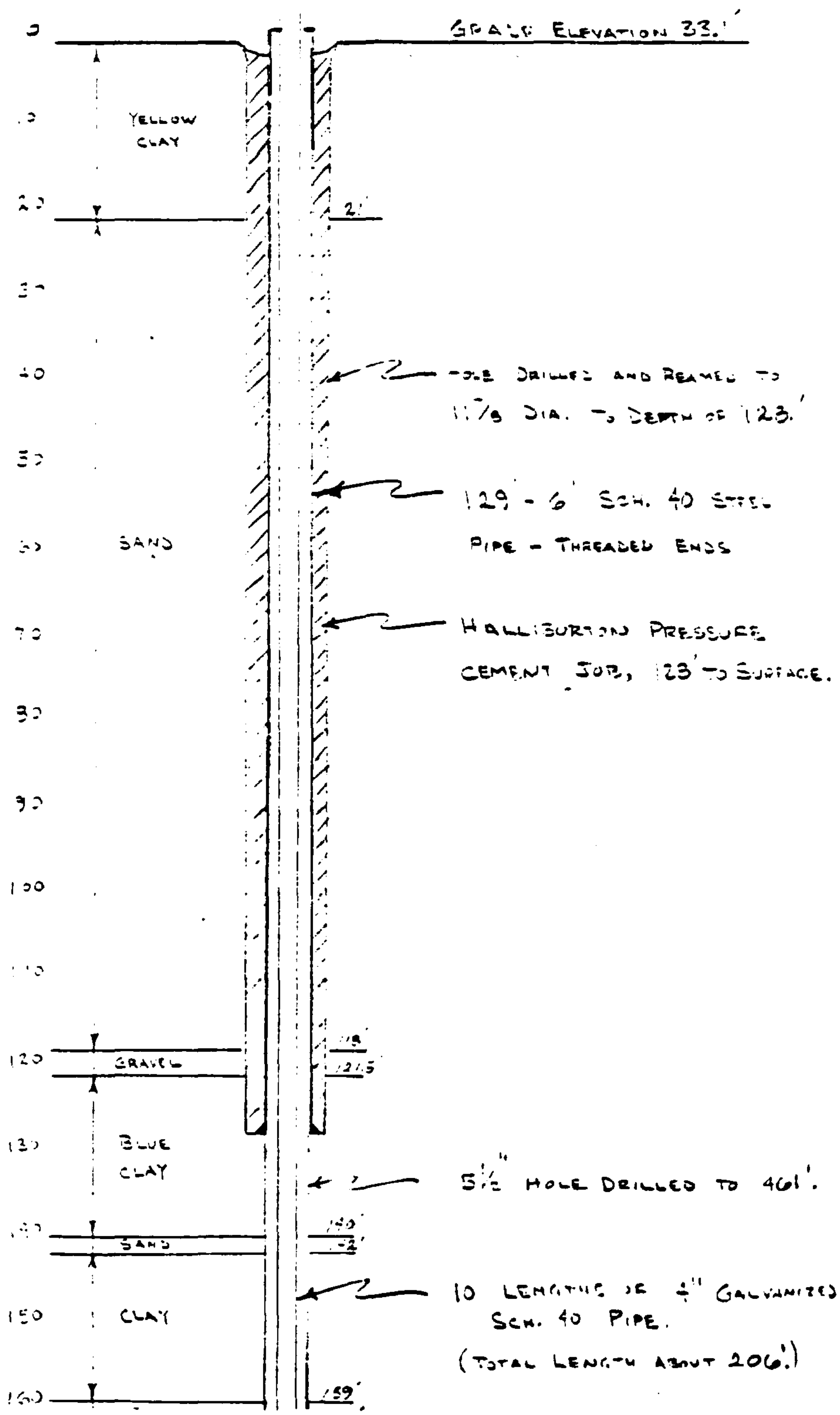
WELL O-28 SHEET 3 OF

W.P.S. 1-12-8

3 10 00473

STAUFFER CHEMICAL COMPANY
GRAPHIC LOG AND CASING DIAGRAM

COLD CREEK PLANT, BUCKS, ALABAMA
EXPLORATORY BORING O-9



NOTES:

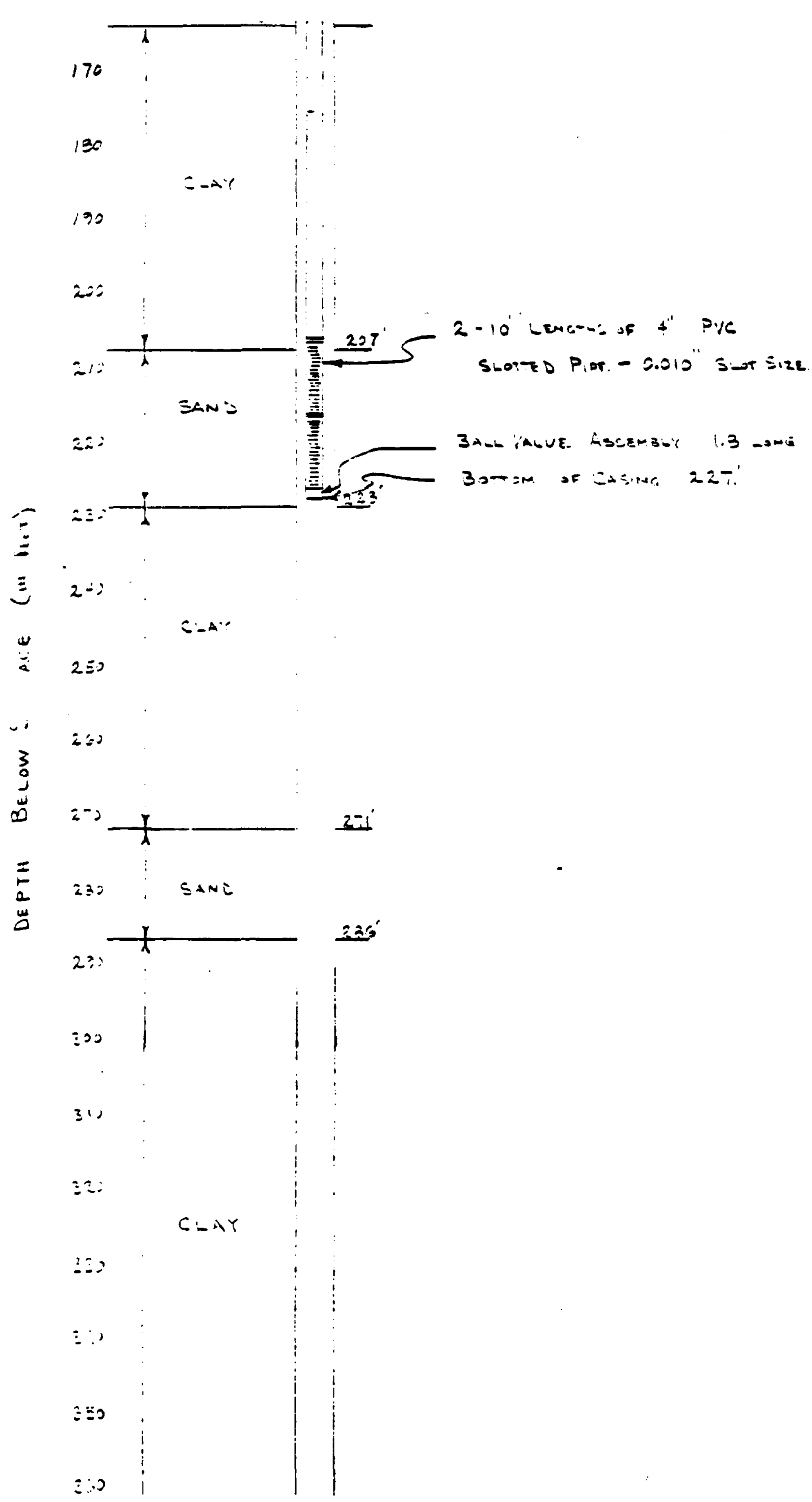
1) SEE REMARKS ON LOG

2) INSTALLED AIR LIFT PUMP & 1/2 AIR LINE 2.0 BELOW TOP OF CASING 3/3/75

3) WELL FIRST SAMPLED 5/

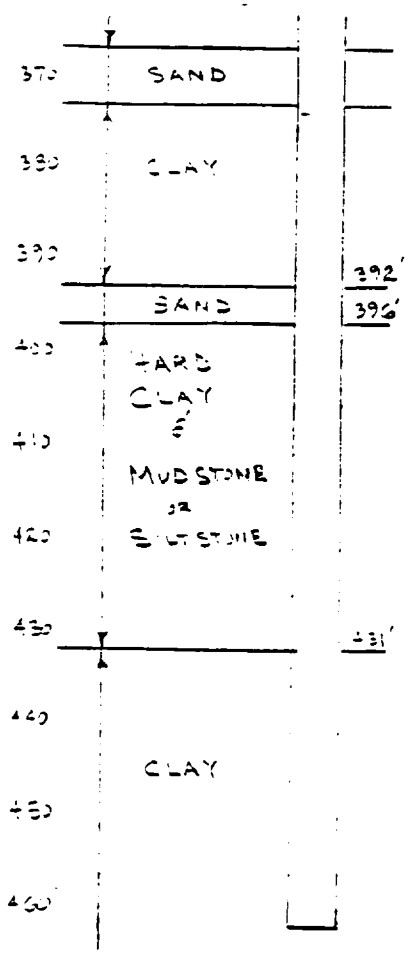
4) REMOVED AIR LIFT PUMP 5.

3 10 00474



DEPTH BELOW SURFACE (IN FEET)
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
360
CLAY
SAND
CLAY
SAND
CLAY
207'
223'
271'
286'
2 - 10' LENGTHS OF 4" PVC
SLOTTED PIPE - 0.010" SLOT SIZE
BALL VALVE ASSEMBLY 1.3 LONG
BOTTOM OF CASING 227'

3 10 00475



TOTAL DEPTH 461' IN CLAY

EXPLORATORY BORING D
W.P.S. 6-1-73

3 10 00476

DESCRIPTIVE WELL LOGS

2468G G361-740

Cold Creek Plant, Buck, Alabama

Exploratory Boring

BEGUN 4/6/73 FINISHED 4/6/73 LOGGED BY WPStilson DRILLED BY Holland Drilling DRILL HOLE 0-5

ELEV. 29.3 (Grade) TOTAL DEPTH 120' LOCATION 662' East and 28' North of NW Corner of "Old" Property Boundary (28' onto newly acquired parcel)

Bit: 5½" 3-Blade Drag Bit Mud: None - Plain Water, but had to use lime.

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
0	3	3		Sand, fine to med., some humus material, roots and plant material	Approx log from mud pit excavation. Soft, easy digging.
0	3	3		As above	
3	20	17		Sand, fine to med, clean, white to buff	Added 4-50# sacks of lime.
20	70	50		Sand, fine to med, clean, white	Added 4-50# sacks of lime.
70	74	4		Sand, med. to coarse, mostly white to buff, contains about 5% colored pebbles (orthoclase and chert)	
74	76	2		Clay, med to dark gray, "Blue Clay"	Drilling a little harder.
76	80	4		Sand, fine to med., white to gray	
80	95	15		Clay, med to dark gray, grades to olive-brown then to lt. bluish gray, contains a few wood fragments	
95	100	5		Sand, coarse to med	Added 4-50# sacks of lime.
100	105	5		Sand, fine	
105	118	13		Sand, med to coarse	
118	120	2		Clay, blue to bluish gray	Took sample from bit. Clay contains gravel from above it up to 3/4"dia. , well-
T.D.	120				

3 10 00477

LeMoyne Plant, Ax Alabama

Explora..ry Boring

BEGUN 4/9/73 FINISHED 4/9/73 LOGGED BY WPStilson DRILLED BY Holland Drilling DRILL HOLE 0-6

ELEV. 40.9 (Grade) TOTAL DEPTH 136' Approx LOCATION 300' East of RR Track (Main Line); 175' South of South Fence Line

Bit: 5½" 3-Blade Drag Bit Mud: None - Plain Water, but had to use lime

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
0	1.0	1		Silty clay, with some fine sand, olive to lt. tan to gray contains roots and some humus material	Approx log from mud pit excavation, moderate digging
1.0	3.5	2.5		Silty clay, with some fine sand, yellow to yellow brown	
0	3.5	3.5		As above	
3.5	10	6.5		Silty clay, yellow to yellow to yellow brown	
10	15	5		Clay, light gray to cream	
15	20	5		Clay, silty with small amt. fine sand, mostly gray but contains a few red streaks	Drilling a little harder
20	52	32		Clay, with 10 to 20% silt and fine sand, lt. gray with a few small red streaks through interval	Drilling easier
52	60	8		Sand, fine to med, clean, white, contains a few small shell fragments	Added 2-50# sacks of lime
60	80	20		Sand, fine to med, clean, white, one streak of yellow clay less than 0.5' thick at about 68'. Becomes med to coarse below 75'.	
80	93	13		Sand, med to fine, mostly white	Added 4-50# sacks of lime.
93	100	7		Sand, med to coarse with 5 to 10% 1/8" to 1/4" size. Increase in number of colored grains (pink, orangish, and yellow-chert and orthoclase). Contains a few wood fragments. White grades to buff to tan. Becomes more coarse with depth.	

3 10 00478

LeMoyne Plant, Axis, Alabama

Exploratory Boring

BEGUN 4/9/73 FINISHED 4/9/73 LOGGED BY WPSLilson DRILLED BY Holland Drilling DRILL HOLE O-6

ELEV. 40.9 (Grade) TOTAL DEPTH 136' Approx LOCATION 300' East of RR Track (Main Line); 175' South of South Fence Line

Bit: 5½" 3-Blade Drag Bit Mud: None - Plain Water, but had to use lime

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
100	130	30		Sand, fine to med, clean, white to lt. gray	Added 3-50# sacks of lime
130	132	2		Sand, coarse to pea gravel 1/8" to 3/8"	
132	134	2		Clay, yellow to yellow brown	
134	136	2		Clay, light gray to light bluish gray	
T.D.	136				

3 10 00479

Cold Creek Plant, [illegible]ks, Alabama

Exploratory Boring

BEGUN 5/2/73 FINISHED 5/2/73 LOGGED BY W.P.Stilson DRILLED BY Holland Drilling DRILL HOLE 0-8

ELEV. 32.8 (Grade) TOTAL DEPTH 122' LOCATION North of New Plant Const. (N. 902.7', W. 014.0' PlantGrid)

Bit: 4½" 3-Blade Drag Bit Mud: None - Plain Water, but had to add lime.

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
0	12	12		Clay, some silty, red, gray, and brown, mostly gray 6' to 12'	Fairly hard drilling
12	14	2		Clay, to silty clay, yellow brown streak	
14	17	3		Clay, silty, mostly gray, silt content increases with depth	
17	20	3		Sand, fine, white to buff, contains some small white shell fragments	
20	35	15		Clay, silty to sandy, buff to light gray	"Soft" - drills easily
35	45	10		Clay, light to med. gray with a few red streaks	
45	55	10		Sand, med. to coarse, white to buff, shells as above	
55	60	5		Sand, coarse (approx. 1/8" size) white to buff, 5 to 10% colored grains	
60	74	14		Sand, med. to coarse (just slightly finer than above), white to buff	
74	77	3		Sand, coarse, white to buff	"Active Sand"-caved in on bit. Started to lose water, added 6-50# sacks of lime.
77	87	10		Clay, color varies - dark gray to olive gray with chocolate brown streaks	
87	90	3		Clay, light gray to light bluish gray	
90	94	4		Clay, light gray to light bluish gray with a few chocolate [illegible] streaks	

3 10 00[illegible]

Cold Creek Plant, Bucks, Alabama

Exploratory Boring

BEGUN 5/2/73 FINISHED 5/2/73 LOGGED BY W.P.Stilson DRILLED BY Holland Drilling DRILL HOLE 0-8

ELEV. 32.8 (Grade) TOTAL DEPTH 122' LOCATION North of New Plant Const. (N. 902.7', W. 014.0' Plant Grid)
Bit: 4½" 3-Blade Drag Bit Mud: None - Plain Water, but had to add lime.

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
94	100	6		Sand, fine, white to buff	
100	107	7		Sand, med. to coarse, buff	
107	121	14		Sand, very coarse to pea gravel	"14' of chatter - cuts extra good"
121	122	1		Clay, bluish gray "Blue Clay"	
T.D.	122			In Blue Clay	

3 10 00451

Cold Creek Plant, [illegible]k, Alabama — Explora[illegible]y Boring

BEGUN 5/14/73 FINISHED 5/14/73 LOGGED BY W.P.Stilson DRILLED BY Holland Drilling DRILL HOLE 0-14

ELEV. 29.8'(Grade) TOTAL DEPTH 120' LOCATION About 180' North of East End of Wooden Bridge (N.922.70', E.1232.04', Plant Grid)

Bit: 4½" 3-Blade Drag Bit Mud: None - Plain water, but had to use lime

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
0	1	1		Sand, clayey, organic material (humus-forest debris, roots)	
1	5	4		Clay, slightly silty, red to reddish brown	
5	11	6		Clay, gray and yellow, with a few small streaks of red	
11	20	9		Sand, fine, white to buff sand with minor amounts of buff to yellow and tan silt and clay, contains a few small shell fragments	
20	30	10		Sand, fine, buff to tan, shells as above	
30	35	5		Sand, medium to fine, buff to tan	
35	40	5		Sand, medium to coarse, buff to tan	Added 1-50# sack of lime
40	50	10		Sand, coarse with some 1/8" plus material, buff to tan, about 5% colored grains	"Lively Sand"
50	60	10		Sand, same as above	
60	70	10		Sand, fine to coarse (mostly medium), buff to lt. gray	Added 1-50# sack of lime
70	80	10		Sand, fine to coarse (mostly coarse), buff to tan, small amount of gravel about 76' to 79' zone. Hit thin streak (less than 1/2 foot) medium gray clay at about 79'.	
80	90	10		Sand, fine to coarse (mostly medium), buff to tan, possible thin streak of reddish yellow clay	

Cold Creek Plant, Bucks, Alabama

Exploratory Boring

BEGUN 5/14/73 FINISHED 5/14/73 LOGGED BY W.P.Stilson DRILLED BY Holland Drilling DRILL HOLE 0-14

ELEV.29.8'(Grade) TOTAL DEPTH 120' LOCATION About 180' North of East End of Wooden Bridge (N.922.70', E.1232.04', Plant Grid)

Bit: 4½" 3-Blade Drag Bit Mud: None - Plain water, but had to use lime

FOOTAGE		THICKNESS	RECOVERY	LITHOLOGY	REMARKS
FROM	TO				
90	100	10		Sand, fine to coarse (mostly coarse), buff to tan, increase in colored grain content to about 5%	Added 1-50# sack of lime
100	110	10		Sand, mostly coarse, same as above	"Chatter" - "cuts well"
110	115	5		Sand, coarse to very coarse, same as above	"Chatter"
115	116	1		Clay, yellow (maybe only ½' yellow clay then blue-gray)	
116	120	4		Clay, lt. bluish gray to lt. gray. "Blue Clay"	
T.D.	120			In Clay	

3 10 00453

Cold Creek Pla Bucks, Alabama Exploratory Boring

BEGUN ./73 FINISHED 7/3/73 LOGGED BY WPStill DRILLED BY Holland Well Co. DRILL HOLE 0-21

(Grade)

ELEV. 27.9' TOTAL DEPTH 120 LOCATION East side of swamp - about 600' east of treatment pond

Bit: 6" 3-blade drag bit Mud: Johnson's Revert

FOOTAGE FROM	FOOTAGE TO	THICK-NESS	RECOV-ERY	LITHOLOGY	REMARKS
0	1	1		Silty sand - slightly clayey, dark brown to yellow	Added 1-25# sack
				brown roots & forest debris top ½ foot	Johnson's Revert
1	3	2		Silty sand (hard clayey silt mixed with fine sand)	
				red to reddish brown	
3	10	7		Silty clay-clayey silt, fairly soft, red brown and	
				yellow brown grades to gray with only streaks of	
				red with depth	
10	20	10		Silty clay, fairly soft, light gray	
20	30	10		Silty clay, about same as above but increase in silt	
				and decrease in clay content with depth - a couple	
				of small streaks of yellow-brown, silty clay	
30	40	10		Clayey silt, somewhat sandy (fine sand) mostly lt.gray	
				with only a few minor streaks of yellow-brown	
40	50	10		Clayey silt, about same as above except for increase	
				in silt and amount of fine sand. A few streaks of	
				med. gray, clayey sand	
50	60	10		Clayey silt, generally about same as above except	
				starting to pick up med. to coarse sand and a small	
				amount of gravel. more streaks of med. gray	
				clayey sand	

3 10 00484

Cold Creek Plant, Bucks, Alabama

Exploratory Boring

BEGUN 7/3/73 FINISHED 7/3/73 LOGGED BY WPStilson DRILLED BY Holland Well Co. DRILL HOLE 0-21

ELEV. 27.9' (Grade) TOTAL DEPTH 120 LOCATION East side of swamp - about 600' east of treatment pond

Bit: 6" 3-blade drag bit Mud: Johnson's Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
60	70	10		Clayey - silty sand, similar to above but grading into a sand, few streaks of lt. gray clay, and a few wood fragments	
70	80	10		Sand, mostly coarse with some pea gravel, a few streaks of gray clay which has traces of red, also streaks of med. gray clayey sand. Streaks of sand grains with a reddish-brown coating (iron oxide-hydroxide).	
80	100	20		Sand, med. to very coarse with some pea gravel, buff to light gray with 10% colored grains	
100	117	17		Sand and gravel, sand is buff to tan to lt. brown, some streaks of sand with (iron oxide-hydroxide?) coatings and streaks of sand grains cemented with this material. Gravel - about 40 to 50% 1/8" to 3/8" with about 20% of this portion colored grains, 5 to 10% of grains larger than 3/8"	"Chatter 105-110"
117	120	3		Clay, stiff, light gray to lt. bluish gray-"blue clay"	
T.D.	120			In blue clay.	

3 10 00465

LeMoyne Pl· Axis, Alabama Explc ory Boring

BEGUN ,/73 FINISHED 7/7/73 LOGGED BY WPStil n DRILLED BY Holland Well Co. DRILL .OLE 0-22

ELEV. 28.0' (Grade) TOTAL DEPTH 105' LOCATION About 25' south of River Road opposite west edge of industrial waste heap

Bit: 6" 3-blade drag bit Mud: Johnson's Revert

FOOTAGE		THICK-NESS	RECOV-ERY	LITHOLOGY	REMARKS
FROM	TO				
0	15	15		Silty sand, just slightly clayey, red to reddish brown	Added 1-25# sack
				with streaks of med. brown; roots & forest debris	Johnson's Revert
				top 1/2 foot	
15	20	5		Silty sand, slightly clayey, reddish brown with	
				streaks of cream and lt. gray clay containing traces	
				of red	
20	40	20		Silty sand, slightly clayey, mostly reddish brown,	
				contains streaks of med. gray silty sand. Hit	
				streak of red-orange-to-yellow clayey silt at 38'	
				to 39'. (More clay streaks in 30 to 40' than in 20'	
				to 30')	
40	50	10		Silty sand, slightly clayey, about same as 30 to 40'.	
				Hit one or more additional streaks of the orange-yellow.	
50	60	10.		Sand, mostly med. with 2 to 3% pea gravel. **Sand is**	
				lt. brown to reddish brown	
60	70	10		Sand, fine to coarse, with 2 to 3% pea gravel. Sand is	
				tan to reddish brown.	
70	80	10		Sand, med. to coarse, tan with about 5% orange and red-	Some "chatter"
				orange grains (iro ide-hydroxide?) coatings & staining	

3 10 00436

LeMoyne Plant, Axis, Alabama

Exploratory Boring

BEGUN 7/6/73 FINISHED 7/7/73 LOGGED BY WPStilson DRILLED BY Holland Well Co. DRILL HOLE 0-22

(Grade)
ELEV. 28.0' TOTAL DEPTH 105' LOCATION About 25' south of River Road opposite west edge of industrial waste heap

Bit: 6" 3-blade drag bit Mud: Johnson's Revert

FOOTAGE FROM	FOOTAGE TO	THICK-NESS	RECOV-ERY	LITHOLOGY	REMARKS
80	95	5		Sand, fine to med., lt. yellow-brown to tan	
95	100	5		Clay, fairly soft, streaks of yellow-orange, cream,	Went from sand to
				lt. and med. gray	clay without hit-
100	105	5		Clay, stiffer, lt. to med. gray and bluish gray	ting gravel
				"Blue Clay"	
T.D.	105			In Blue Clay	

3 10 00487

LeMoyne Plar Axis, Alabama

Explc ory Boring

BEGUN .0/73 FINISHED 7/10/73 LOGGED BY WPSti n DRILLED BY Holland Well Co. DRILL HOLE 0-23

ELEV. 9.5' (Grade) TOTAL DEPTH 80' LOCATION Adjacent to east side of industrial waste heap about 250' north of River Road

Bit: 6" 3-blade drag bit Mud: Johnson's Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
0	10	10		Silty sand, slightly clayey, lt. tan, reddish brown, and lt. to med. gray, dark brown; roots and forest debris top ½ to 1 foot	Added 1-25# sack of Johnson's Rever
10	20	10		Silty sand, slightly clayey, reddish-brown to yellow-brown	
20	35	15		Sand, fine to coarse, tan to lt. brown	Some "chatter"
35	40	5		Sand and clay, gradational contact	
40	50	10		Clay, sandy and silty; soft, lt. grayish brown, some lt. gray clay with traces of red, and some yellow-brown color	
50	60	10		Sand and gravel (med to coarse sand with gravel), strong orange-brown coloration from both coatings on grains and intermixed orange silty clay	
60	76	16		Sandy clay and silty clay, fairly soft, contains streaks of sand, some of which contain thin seams of cemented grains. Cementing agent is red to yellow-brown (iron oxide-hydroxide). Clay gets stiffer with depth	
76	80	4		Clay, stiff, bluish "Blue Clay"	
T.D	80			In Blue Clay	

3 10 00488

LeMoyne Plant, Axis, Alabama

Exploratory Boring

BEGUN 7/11/73 FINISHED 7/11/73 LOGGED BY WPStilson DRILLED BY Holland Well Co. DRILL HOLE 0-24

(Grade)

ELEV. 9.9' TOTAL DEPTH 63' LOCATION About 100' south and 150' west of southwest corner of barge slip at River

Bit: 6" 3-blade drag bit Mud: Johnson's Revert

FOOTAGE FROM	FOOTAGE TO	THICK-NESS	RECOV-ERY	LITHOLOGY	REMARKS
0	8	8		Clay, silty and sandy clay mostly gray with red streaks, dark brown to tan sandy silty with roots and forest debris top 1/2 to 1 foot	Added 1-25# sack of Johnson's Rever
8	13	5		Silty clay with small amt. fine sand, mostly gray with some yellow and yellow brown	
13	18	5		Silty clay, fairly stiff, slight amount of fine sand, lt. gray	
18	22	4		Silty clay, soft, sand content increases with depth, lt. gray	
22	35	13		Sand, fine to very coarse (mostly med. to coarse), buff to lt. brown with yellow brown silt and grain coatings	
35	40	5		Clay? 5' interval of soft clay intermixed with fine sand, lt. brown to med. gray	
40	50	10		Sand, med. to coarse with about 5% pea gravel, buff to white with minor streaks of gray - about 5% colored grains	Looks like a fairly clean sand

3 10 00489

LeMoyne Plan Axis, Alabama

Explo ory Boring

BEGUN 1/73 FINISHED 7/11/73 LOGGED BY WPStil DRILLED BY Holland Well Co. DRILL HOLE 0-24

(Grade)

ELEV. 9.9' TOTAL DEPTH 63' LOCATION About 100' south and 150' west of southwest corner of barge slip at River

Bit: 6" 3-blade drag bit Mud: Johnson's Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
50	59	9		Sand, fine to coarse (mostly med. to coarse), gets more coarse with depth, buff to lt. gray, about 5% colored grains	"Locked-up" bit at 55'
59	60	1		Clay, silty, soft, yellow-brown and lt. and med. gray	
60	63	3		Clay, stiff, lt. gray to lt. bluish gray, "Blue Clay"	
T.D.	63			In "Blue Clay"	

3 10 00420

BEGUN 3/9/81 FINISHED 3/10/81 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE 0-59

GRADE ELEV. 35.3 TOTAL DEPTH 123 LOCATION Stauffer Grid Coordinates S. 1261.5 E. 2563.5

Bits: 8 1/2" Drag Bit 0 to 6'
6" Drag Bit 6' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	TO	THICKNESS	LITHOLOGY	REMARKS
0	4	4	Clay, silty to sandy, fairly stiff, red-brown, and some yellow-brown	
4	10	6	Sand, fine, buff to tan, mixed with minor silty clay	
10	20	10	Sand, fine to medium (mostly fine), white to buff	
20	40	20	Clay, silty to sandy, buff to tan with streaks of soft lt. gray clay	"Drilled soft"
40	51	11	Clay, silty to sandy, soft to moderately stiff, white to lt. gray intermixed with streaks of lt. gray clay	
51	60	9	Sand, medium to coarse, traces of gravel, white to lt. gray	"Light chatter 55-60"
60	67	7	Sand, medium to coarse, buff to white	Taking fluid
67	68	1	Sand, medium to coarse, minor gravel, color change - red-brown to orange-brown, staining on sand and gravel	Taking fluid
68	71	3	Clay, moderately stiff, lt. gray, traces of orange staining & wood fragments	
71	80	9	Sand, medium to coarse, lt. gray to tan	"Lively sand" Taking fluid
80	90	10	Sand, medium to coarse, (mostly coarse) buff to tan, lt. yellow-brown staining on ≃ 5% of grains	Taking fluid
90	100	10	Sand, medium to coarse, with minor fine, buff to tan, lt. gray and cream, clay streaks, probable 95-100', traces of wood fragments, staining on ≃ 5% of grains	Taking fluid
100	'7	17	Sand, fine to medium, mostly fi [illegible] buff to tan, hit hard streak just	

3 10 00491

LeMoyne Plan' Axis, Alabama

BEGUN _ '81 FINISHED 3/10/81 LOGGED BY W.P.St on DRILLED BY Holland Well Company DRILL LE 0-59

GRADE

ELEV. 35.3 TOTAL DEPTH 123 LOCATION Stauffer Grid Coordinates S. 1261.5 E. 2563.5

Bits: 8 1/2" Drag Bit 0 to 6'
6" Drag Bit 6' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
117	120	3	Clay, stiff, lt. gray to lt. bluish gray	
120	123	3	Clay, stiff, bluish gray	
T.D.	123		in stiff bluish clay	

3 10 00492

Lemoyne Plant, Axis, Alabama

BEGUN 3/11/81 FINISHED 3/12/81 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE 0-62

GRADE ELEV. 33 TOTAL DEPTH 120 LOCATION Stauffer Grid Coordinates S. 1790.0 E. 2479.5

Bits: 8 1/2" Drag Bit 0 to 6'
6" Drag Bit 6' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	5	5	Clay, silty to sandy, hard, (top 2 to 3' was compacted fill-similar material)	
5	10	5	Sand, silty to clayey (fine to medium sand) lt. yellow-brown	
10	15	5	Sand, fine to medium, white to buff	
15	20	5	Sand, coarse and some gravel to + 1/4"	
20	40	20	Clay, silty, moderate to soft, lt. gray and tan, some medium gray with inter-bedded streaks of fine sand	
40	47	7	Clay, moderately stiff, lt gray to almost white	
47	49	2	Sand, medium to coarse, buff to white	
49	60	11	Clay, moderate to soft, lt. gray to buff, thin sandy streaks probable	
60	80	20	Sand, fine to coarse, (mostly medium) buff to white	
80	95	15	Sand, fine to med. (some coarse), buff to white, possible clay streaks	
95	100	5	Sand, fine, white to buff, with 1' to 2' thick clay streak (lt. gray)	
100	114	14	Sand, med. to very coarse, minor gravel, moderate to heavy staining on more than 5% of grains (rust to brown)	
114	115	1	Sand, coarse, cemented (?) "sandrock" - drilled very hard, heavy staining + 5%	
115	116	1	Silt to silty clay, orange, (less than 1' thick)	
116	120	4	Clay, stiff, lt. bluish gray	
T.D.	0		In stiff bluish clay	

3 10 00493

LeMoyne Plan+ Axis, Alabama

BEGUN /81 FINISHED 8/25/81 LOGGED BY W.P.St DRILLED BY Holland Well Company DRILL E 0-68

GRADE ELEV. 24' TOTAL DEPTH 119' LOCATION Stauffer Grid Coordinates S. 1028.18 E. 1546.41

Bits: 8 1/2" Drag Bit 0 to 6'
6" Drag Bit 6' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	TO	THICKNESS	LITHOLOGY	REMARKS
0	6	6	Clay, to sandy clay, firm, fill material contains old paving (clam) shells and debris	
6	7	1	Silt to clayey silt, black organic material, roots, etc. (top of depressed surface of pre-filled swamp in this area)	
7	10	3	Sand, silty to clayey, fine peaty (organic rich), fairly soft, tan to lt. yellow-brown and gray with streaks of black decayed swamp vegetation	
10	20	10	Sand, fine, silty to slightly clayey, lt. to medium gray	"Drilled fairly firm"
20	24	4	Sand, as above with sand content increasing, lt. to medium gray	
24	30	6	Sand, fine silty with trace of clay, yellow-brown	"Fairly soft"
30	42	12	Sand, fine to medium (mostly fine) slightly silty, lt. yellow-brown to tan, thin streaks of lt. gray clay	"Drilled somewhat soft"
42	50	8	Sand, medium to coarse, with 10% gravel + 1/8" to + 1/4", tan, light orange-brown (iron) staining on some of gravel, minor clay streak possible	"Drilled slightly softer than above, but had a light chatter"
50	60	10	Sand, medium to coarse, with minor gravel, tan to gray, traces of staining (iron) on grains, minor streaks of buff, tan, and lt. gray clays, traces of dark gray to black silt or clayey silt	Taking fluid
60	70	10	Sand, medium to coarse, minor amount fine, with trace of gravel, tan to lt. gray, thin clay streaks ble, traces of staining	Taking fluid "Light c ter"

3 10 00494

BEGUN 8/25/81 FINISHED 8/25/81 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE 0-68

GRADE ELEV. 24 TOTAL DEPTH 119 LOCATION Stauffer Grid Coordinates S. 1028.18 E.1546.41

Bits: 8 1/2" Drag Bit 0 to 6"
6" Drag Bit 6' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
70	79	9	Sand, medium to very coarse, 3 to 5% gravel +1/4", minor amt. +1/2", lt. to medium gray, thin streaks of lt. gray clay possible	Taking fluid "Light chatter"
79	80	1	Clay, fairly firm, lt. gray - almost white (about 1-1/2' to 2' thick)	
80	90	10	Sand, fine to coarse (mostly coarse) trace of gravel, tan to lt. grayish tan	Taking fluid "Chatter"
90	100	10	Sand, fine to coarse (mostly coarse), minor gravel, lt. gray	Taking fluid "Chatter"
100	117	17	Sand, very coarse to gravel, 50% +1/8", about 30% +1/4"	Taking fluid "Heavy chatter"
117	118	1	Sand, medium to coarse, partially cemented, thin "sandrock" gray to lt. brown red-brown (iron) staining slight color change in drilling fluid	Mud pit almost empty
118	119	1	Clay, stiff, lt. bluish gray	
T.D.	119		In "blue clay"	

LeMoyne Plar Axis, Alabama

BEGUN _ 28/81 FINISHED 8/28/81 LOGGED BY W.P.St on DRILLED BY Holland Well Company DRILL LE 0-70

GRADE ELEV. 28.7 TOTAL DEPTH 118 LOCATION Stauffer Grid Coordinates S. 1259.32 E. 1662.19

Bits: 8 1/2" Drag Bit 0 to 7'
6" Drag Bit 7' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	TO	THICK-NESS	LITHOLOGY	REMARKS
0	0.5	0.5	Topsoil	
0.5	20	19.5	Clay, to silty clay, trace of fine sand, firm, lt. gray with minor yellow-brn	
20	30	10	Clay, to silty clay, minor fine sand, moderately firm, medium to dark gray	
30	40	10	Silt, clayey, with fine sand, moderate to soft, lt. to medium gray possible	
			sand streak at 38'	
40	50	10	Sandy silt - silty sand, fine, clayey, soft, lt. and medium gray, traces of	
			yellow-brown, minor lt. brown sand	
50	55	5	Sand, silty to clayey sand grades to sand, lt. gray	
55	60	5	Sand, fine to coarse, traces of gravel, lt. gray to buff	"Light chatter" Taking fluid
60	78	18	Sand, fine to coarse, traces of gravel, buff to tan, clay streaks at 62'	
			possible at 68', other thin streaks possible (lt. and medium gray)	
78	81	3	Clay, moderate to soft, lt. gray to white	
81	90	9	Sand, medium to coarse, some fine, tan to lt. gray, staining (iron) on	
			3 to 5% of grains	
90	100	10	Sand, fine to coarse with minor gravel ≃ 5% +1/4", tan to lt. gray, inter-	
			bedded streaks of soft lt. and medium gray clay probable.	
100	110	10	Sand, very coarse and gravel, about 20% +1/4" and 3% +1/2", buff to gray,	
			staining (iron) on 1 to 3% o ins	

3 10 00496

BEGUN 8/28/81 FINISHED 8/28/81 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE 0-70

GRADE ELEV. 28.7 TOTAL DEPTH 118 LOCATION Stauffer Grid Coordinates S. 1259.32 E. 1662.19

Bits: 8 1/2" Drag Bit 0 to 7'
6" Drag Bit 7' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
110	116	6	Sand and gravel as above, but about 5% +1/2", and staining on 3 to 5% of grains.	
116	117	1	Clay, silty, stiff, yellow to yellow-orange, much less than 1' thick, very thin "sand rock" on top	
117	118	1	Clay, very stiff, bluish gray	
T.D.	118		In stiff blue clay	

3 10 00497

[illegible] CHEMICAL COMPANY DRILL LOG

Page 1 of [illegible]

BEGUN [illegible] FINISHED [illegible] LOGGED BY [illegible] DRILLED BY [illegible] DRILL HOLE TW-12

[illegible]

ELEV. [illegible] TOTAL DEPTH [illegible] LOCATION [illegible]

[illegible]

[illegible] 3397 [illegible]

BEST AVAILABLE COPY

FOOTAGE FROM	FOOTAGE TO	THICKNESS		LITHOLOGY	REMARKS
0	5	5		CLAY, [illegible]	
5	10	5		CLAY, [illegible] STIFF, LT. GRAY	
10	20	10		CLAY, SILTY TO [illegible]	
20	25	5		CLAY [illegible]	
25	30	5		SAND, [illegible]	
30	40	10		SAND [illegible]	[illegible]
40	50	10		SAND, MED. TO [illegible] WITH TRACE OF [illegible]	
				TRACE OF [illegible] VERY [illegible]	
50	60	10		SAND, ABOUT SAME [illegible]	[illegible]
60	70	10		SAND, COARSE TO VERY [illegible] BUFF WITH 10-20% COLORED GRAINS [illegible] STREAKS	[illegible] LIGHT [illegible]
70	74	4		CLAY, MED. STIFF, LT. TO MED. GRAY [illegible]	
74	80	6		CLAY, [illegible] 20 [illegible]	
80	93	13		CLAY, SOFT TO MED. STIFF, [illegible] MED. GRAY WITH MINOR [illegible]	
				OF LT. [illegible], BROWN-GRAY [illegible] CLAY	
				[illegible]	
93	100	7		SAND, VERY [illegible], WHITE [illegible]	
100	110	10		SAND, MED. TO VERY [illegible] 1/8" [illegible]	TAKING FLUID "LIGHT [illegible]"
110	122	12		SAND, COARSE TO VERY COARSE (TRACE OF 1/8") BUFF, ABOUT 3 TO 5% [illegible]	TAKING FLUID "LIGHT CHARGE"
[illegible]	[illegible]	[illegible]		[illegible]	

3 10 05 [illegible]

BEGUN 3/[illegible]/77 FINISHED 9/25/77 LOGGED BY W[illegible] DRILLED BY [illegible] PAGE 2 DRILL HOLE TW-12

ELEV. [illegible] TOTAL DEPTH 145 LOCATION [illegible]

[illegible] W[illegible] CO. [illegible]

[illegible]

FOOTAGE FROM	FOOTAGE TO	THICKNESS		LITHOLOGY	REMARKS
T.D.	124.5			N[illegible] 10' [illegible] SCREEN WITH 0.0[illegible]"	
				[illegible] AT 118 [illegible] GROUND SURFACE.	BEST AVAILABLE COPY
				11 N[illegible] 11-3, [illegible] THE	
				[illegible] 30"	
				[illegible] 24' [illegible]	
				TO [illegible]. N[illegible] AT 23'	
				H[illegible] TO T[illegible] (?) TO 32".	
				20' OF 12" [illegible], 0.025 [illegible] STAINLESS STEEL [illegible]	
				SCREEN [illegible] 14" STEEL [illegible] CASING.	
				WITH THE 14" [illegible] ON	
				SCREEN THEY [illegible] OF SCREEN [illegible] AT 118.	
				([illegible] -3 - 118.	
				COMMENT: IF THE [illegible], THE SCREEN WAS	
				PLACED ABOUT 6 FEET TO HIGH. THEY MISSED THE	
				BOTTOM 6' OF THE [illegible] AND THE TOP	
				OF THE SCREEN WAS OPPOSITE FINE SAND.	
				I [illegible] THAT THIS [illegible] IN MARCH OF 1973 [illegible] 20' OF 8"	
				DIA. STAINLESS SCREEN AND 10' OF 8" LAP PIPE [illegible] (?)	
				[illegible] (?)	

3 10 00499

BEGUN 3 75 FINISHED 3/25/75 LOGGED BY W.P.Stin DRILLED BY Holland Well Co. Explor y Boring DRILL HOLE 0-28

ELEV. Approx 35' Grade TOTAL DEPTH 610' LOCATION N.899.67', E.315.0' Plant Grid

Bit 6" 3-Blade Drag Bit Mud: Carloss Hi-Gel Bentonite

FOOTAGE FROM	TO	THICK-NESS	RECOV-ERY	LITHOLOGY	REMARKS
0	10	10		Clay, silty, fairly stiff, yellow with streaks of light gray, and minor streaks of red.	
10	16	6		Clay, fairly stiff, light gray, with minor streaks of red.	
16	17	1		"Sand rock," 6" to 8" thick streak of limonitic(?) cemented sand.	"drilled hard"
17	28	11		Clay, slightly soft, medium to dark gray.	
28	33	5		Sand, fine, light gray to white.	
33	34	1		Sand, fine to medium, reddish brown.	
34	40	6		Sand, medium, buff to light tan, contains iron stained grains.	Added 3-50# sacks Hi-Gel Bentonite.
40	50	10		Sand, medium to coarse, buff to white.	Formation taking fluid, Added 6-50# sacks Hi-Gel Bentonite.
50	57	7		Sand, coarse.	
57	64	7		Sand, coarse, and small gravel.	
64	70	6		Clay, slightly stiff, light gray.	

3 10 0603

BEGUN 3/20/75 FINISHED 3/25/75 LOGGED BY W.P.Stilson DRILLED BY Holland Well Co. Exploratory Boring DRILL HOLE 0-28

ELEV. Approx 35' Grade TOTAL DEPTH 610' LOCATION N.899.67', E.315.0' Plant Grid

Bit 6" 3-Blade Drag Bit Mud: Carloss Hi-Gel Bentonite

FOOTAGE FROM	FOOTAGE TO	THICK-NESS	RECOV-ERY	LITHOLOGY	REMARKS
70	77	7		Clay, sandy, slightly stiff, light gray.	
77	80	3		Clay, moderately stiff, medium to dark gray, contains wood fragments.	
80	94	14		Clay, moderately stiff, light to medium gray to slight bluish gray.	
94	100	6		Sand, medium to coarse, and gravel.	
100	113	13		Sand, coarse, and gravel.	
113	122	9		Clay, very stiff, bluish gray.	
				Note: Drilling of 6" hole was stopped. Redrilled hole with 11-7/8" bit to depth of 123 feet. Ran in 123'-2½" of 6" steel pipe and pressure cemented in hole. Started drilling 5½" hole inside 6" pipe.	
118	123	5		Drilled out cement.	
123	130	7		Clay, slightly silty, stiff, bluish green.	
130	160	30		Clay	
160	170	10		Clay, silty to sandy, moderately stiff, possible sand streaks.	
170	190	20		Clay, sandy, soft, (interbedded sand streaks).	

COLD CREEK PLANT BUCKS, ALABAMA

Exploratory Boring

BEGUN 3 75 FINISHED 3/25/75 LOGGED BY W.P.Stil DRILLED BY Holland Well Co. DRILL HOLE 0-28

ELEV. Approx 35' Grade TOTAL DEPTH 610' LOCATION N.899.67', E.315.0' Plant Grid

Bit 6" 3-Blade Drag Bit Mud: Carloss Hi-Gel Bentonite

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
190	200	10		Clay.	
200	210	10		Clay, silty to sandy, soft.	
210	220	10		Sand, mostly fine sand, with minor clay streaks, (clay could be from up-hole).	
220	236	16		Sand, mixed with clay	"Drilled soft." "Slight chatter just before 236 feet."
236	240	4		Clay, stiff, medium gray and greenish gray.	
240	250	10		Clay, slightly sandy, stiff, bluish green.	
250	266	16		Clay, slightly sandy, stiff, bluish gray, (grades to medium to dark gray, soft, sandy clay).	
266	270	4		Sand, sand streaks in a stiff clay.	"Some chatter."
270	280	10		Sand streaks interbedded in a light bluish gray stiff clay, (minor gravel noted that could be from the 266-270' interval - circulated 10 minutes).	
280	290	10		Clay, stiff.	
290	296	6		Clay, stiff, bluish green.	

Exploratory Boring
DRILL HOLE O-28

BEGUN 3/20/75 FINISHED 3/25/75 LOGGED BY W.P.Stilson DRILLED BY Holland Well Co.

ELEV. Approx 35' Grade TOTAL DEPTH 610' LOCATION N.899.67', E.315.0' Plant Grid

Bit 6" 3-Blade Drag Bit Mud: Carloss Hi-Gel Bentonite

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
296	300	4		Sand(?) or streaks of fine sand in soft clay.	"Drilled soft."
300	310	10		Clay, stiff, bluish green, (hit log at 305' - some wood fragments and also some brown-black silty clay).	
310	320	10		Clay, stiff, blue-green and medium gray.	"Hard drilling."
320	330	10		Clay, stiff, as above but with some olive green.	"Some chatter at 320-323 feet." (?)
330	350	20		Clay, soft.	
350	360	10		Clay, soft, bluish green, light to medium gray sandy clay, and brown-black silty clay, also minor wood fragments.	
360	370	10		Clay, soft, bluish green, more green and less of the brown-black than above.	
370	380	10		Clay, very stiff, mostly green and gray green, with minor amount soft, brown, silty to sandy clay.	"Hard drilling."
380	390	10		Clay, stiff, light to medium gray, and green tones (almost no sand at all).	
390	420	30		Clay, stiff, mostly light gray to greenish gray (almost no sand at all).	

3 10 00503

BEGUN 3, 75 FINISHED 3/25/75 LOGGED BY W.P.Stil[illegible] DRILLED BY Holland Well Co. Explor[illegible]y Boring DRILL HOLE 0-28

ELEV. Approx 35' Grade TOTAL DEPTH 610' LOCATION N.899.67', E.315.0' Plant Grid

Bit 6" 3-Blade Drag Bit Mud: Carloss Hi-Gel Bentonite

FOOTAGE FROM	TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
420	430	10		Clay, stiff, but just slightly softer than last 30 feet; also, slightly more silty than last 40 feet.	
430	440	10		Clay, slightly silty with traces of sand, sand content increasing with depth, stiff, mostly light gray to greenish gray.	
440	450	10		Clay, about same as above, but sand content increasing.	
450	460	10		Clay, with streaks of medium sand.	"Chatter 450-460 feet."
460	470	10		Clay, with streaks of medium to fine sand.	"Chatter 460-466 feet, soft 466-470 feet."
470	490	20		Clay, medium gray sandy clay, light gray stiff clay, softer cream-colored clay with fine sand, green clay with medium sand, and olive green clay.	"Light chatter." (?) Washed sample does show some sand.
490	500	10		Clay, about same as above (470-490), but starting to get more stiff blue-green clay again.	
500	510	10		Clay, about same as 490-500, but with slight increase in amount of fine sand.	
510	520	10		Clay, about same, increase in amount of fine sand.	"Some chatter."

3 10 00504

COLD CREEK PLANT, BUCKS, ALABAMA

Exploratory Boring

BEGUN 3/20/75 FINISHED 3/25/75 LOGGED BY W.P.Stilson DRILLED BY Holland Well Co. DRILL HOLE 0-28

ELEV. Approx 35' Grade TOTAL DEPTH 610' LOCATION N.899.67', E.315.0' Plant Grid

Bit 6" 3-Blade Drag Bit Mud: Carloss Hi-Gel Bentonite

DEPTH FROM	DEPTH TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
520	550	30		Clay, medium gray to a bluish gray stiff clay, some olive green clay, minor amount of soft cream clay containing fine sand.	
550	560	10		Clay, not as stiff as above, medium to dark gray, also dark brown to black soft clay. Definite increase in fine sand content.	
560	570	10		Sand, fine to medium, mixed with soft clay streaks.	"Chatter 566-570 feet."
570	580	10		Sand, medium to coarse.	"Good chatter."
580	600	20		Sand, fine to coarse, mostly medium to coarse.	"Good chatter."
600	610	10		Sand, medium to coarse.	"Got somewhat soft, did not cut as good as above."
T.D.	610			In sand, but probably near the bottom of the sand.	

Notes: (1) Installed 10' section of 4" diameter, 0.010" slot well screen. Screen is set from 580 to 590 feet below ground surface (approx. ±1.0'). Came out of hole with 582 feet of 4½" O.D. x 0.237" wall, 11 lb/ft, ASTM A-120 threaded pipe.

(2) Checked well on 3/28/75. Well will flow at rate of about 175 GPM (measured drop with open discharge as per Water Well Handbook). Shut-in pressure at surface is about 15 psi.

3 10 00505

Cold Creek Plant, [illegible]ks, Alabama

Explor[illegible]ry Boring

[illegible] 5/3/73 FINISHED 5/7/73 LOGGED BY W.P. Stilson DRILLED BY Holland Drilling DRILL HOLE 0-9

EL[illegible] Approx. 33' Grade TOTAL DEPTH 461' LOCATION 10' North of Paint Shop (S. 002.71', E. 577.72' Plant Grid)

Bit: 4½" 3-Blade Drag Bit Mud: Lime and Bentonite Used When Reaming First 128' of Hole to 11 7/8" Dia

FOOTAGE FROM	TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
0	3	3		Sand, clayey, red, (fill)	
3	21	18		Clay, slightly silty, yellow	
21	30	9		Sand, med. to fine, buff to white, contains a few small white shell fragments	
30	40	10		Sand, fine, same as above	Added 1-50# sack of lime
40	55	15		Sand, med., same as above	
55	60	5		Sand, coarse, grades to gravel, buff to white	
60	70	10		Sand, coarse to med., buff to white, about 10% pea gravel	
70	80	10		Sand, coarse to med., buff to white, about 20% pea gravel, increase in colored grain content to about 10%. Hit one or more thin streaks of gray clay	Driller could not "feel" the clay
80	100	20		Sand, fine to coarse, buff to white. Looks like a "red sand" but grains are 80% white, buff, lt. gray, and colorless with 20% colored grains	Red coloration comes from streaks of red silt or red silty clay
100	112	12		Sand, med. to coarse, red coloration decreases with depth, 5 to 10% pea gravel, contains a few small shell fragments	
112	118	6		Sand, very coarse, grades to pea gravel	Added 2-50# sacks of lime "Chatter"
118	121.5	3.5		Gravel, 3/8" to 1[illegible]"	"Chatter" [illegible]ook sample)

2 1 0 0 3 0 0

Cold Creek Plant, Bucks, Alabama

Exploratory Boring

BEGUN 5/3/73 FINISHED 5/7/73 LOGGED BY W.P. Stilson DRILLED BY Holland Drilling DRILL HOLE 0-9

ELEV. Approx. 33' Grade TOTAL DEPTH 461' LOCATION 10' North of Paint Shop (S. 002.71', E. 577.72' Plant Grid,

Bit: 4½" 3-Blade Drag Bit Mud: Lime and Bentonite Used When Reaming First 128' of Hole to 11 7/8" Dia

FOOTAGE FROM	TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
121.5	128	6.5		Clay, gray to light bluish gray "Blue Clay"	T.D. for day May 4, 1972. Reamed 11-7/8" hole to 128'. Installed 129' 6" casing. Pressure cemented casing in hole.
128	140	12		Clay, bluish gray, "Blue Clay"	Resumed drilling 5/7/73. Only slight amount of cement at bottom of hole.
140	142	2		Sand, fine	Questionable. Did not see cutting
142	159	9		Clay, gray and bluish-green	
159	163	4		Sand, fine to very fine, buff to light gray	
163	171'	8		Clay, color varies, 70% blue to bluish green, 30% olive	
171	181	10		Clay, about same as above except some gray or lt. bluish gray coming in	
181	191	10		Clay, about same as above except less olive.	
191	201	10		Clay, about same as above	Cutting somewhat slower; cuttings are finer and "less gritty"

3 10 00507

Cold Creek Plant, [illegible]ks, Alabama

Explora[illegible]y Boring

BEGUN 5/3/73 FINISHED 5/7/73 LOGGED BY W.P.Stilson DRILLED BY Holland Drilling DRILL HOLE 0-9

ELEV. Approx. 33' Grade TOTAL DEPTH 461' LOCATION 10' North of Paint Shop (S. 002.71', E. 577.72' Plant Grid)

Bit: 4½" 3-Blade Drag Bit Mud: Lime and Bentonite Used When Reaming First 128' of Hole to 11 7/8"Di[illegible]

FOOTAGE FROM	FOOTAGE TO	THICKNESS	RECOVERY	LITHOLOGY	REMARKS
201	207	6		Clay, about same as above	
207	211	4		Sand, med. to fine	"Lively Sand" - losing water
211	221	10		Sand, med. to coarse but mostly coarse last 5', grains clear, white and lt. gray, about 5% colored grains with a few black grains	Added 2-50# sacks of lime
221	228	7		Sand, fine to coarse (mostly coarse), grains white to light gray with about 3% colored grains	Still losing water. Added 2-50# sacks of lime
228	242	14		Clay, light bluish gray, gray, and blue	Brought up wood fragment
242	251	9		Clay, about same as above. Brought up a slight amount of black material in the 245 to 248' range. Material is soft, silt sized, and has no odor. (Soft lignite?)	Drilling harder. Brought up a few wood fragments.
251	271	20		Clay, mostly blue but some bluish gray and bluish green with a slight amount of gray	Drilling easier agai[illegible]
271	286	15		Sand, fine to medium	Very little recovery of sand in cuttings. Returns mostly clay.
286	291	5		Clay, bluish gray to bluish green with increasing amounts of medium to dark gray	
291	295	4		Clay, same as above	Drilling hard
295	301	6		Clay, same as above, gray tones increasing	
301	311	10		Clay, same as ab[illegible]	Drilling [illegible]
31[illegible]	341	30		Clay, more blui[illegible] and less gray	

3 10 00508

Cold Creek Plant, Bucks, Alabama

Exploratory Boring

BEGUN 5/3/73 FINISHED 5/7/73 LOGGED BY W.P.Stilson DRILLED BY Holland Drilling DRILL HOLE 0-9

ELEV. Approx. 33' Grade TOTAL DEPTH 461' LOCATION 10' North of Paint Shop (S. 002.71', E. 577.72' PlantGrid)

Bit: 4½" 3-Blade Drag Bit Mud: Lime and Bentonite Used When Reaming First 128' of Hole to 11 7/8"Dia

FOOTAGE		THICKNESS	RECOVERY	LITHOLOGY	REMARKS
FROM	TO				
341	351	10		Clay, same as above	Drilling hard
351	366	15		Clay, same as above	Drilling easier
366	372	6		Sand	Very little recovery of sand in cuttings returns are mostly clay
372	381	9		Clay, same as clay above sand	
381	392	11		Clay, about same as above	Drilling hard
392	396	4		Sand	About 4' of sand - very little recovery
396	401	5		Clay, probably thin interbedded seams of mudstones or siltstones	Drilling very hard 399' to 401'
401	431	30		Clay	Drilling very hard; cuttings are mostly clay.
431	441	10		Clay	Drilling easier below 433'
441	451	10		Clay, increasing in blue-green tones, decreasing in gray tones	
451	461	10		Clay, about same as above	
T.D.	461			In Clay	No more drill steel.
				(pipe in 21' sand at 207 to 228'. Came out of hole with 4" galv. pipe.)	May 8, 1972. Reamed 5½" hole from 128' to 228'. Installed 20' of 4 ted PVC

3 10 00509

Lemoyne Plant Axis, Alabama Page 1 of

BEGUN _ 34 FINISHED 4/6/84 LOGGED BY W.P.Sti DRILLED BY Holland Well Company DRILL HOLE CNAM-34
GRADE
ELEV. 42.2' TOTAL DEPTH 128.5' LOCATION Stauffer Grid Coordinates S.2480±5' E.1890±5'
Drilled on Courtaulds North America Property
Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	8	8	Clay, stiff, red brown to light yellow brown.	
8	10	2	Clay, fairly stiff, silty to sandy, light yellow brown to red brown.	
10	16	6	Clay, slightly stiff, silty to sandy (grades into sand), tan, light reddish brown and yellow brown.	
16	30	14	Sand, fine to coarse, with minor gravel, buff to light gray.	"Good chatter"
30	44	14	Sand, fine to coarse, buff to light gray, contains thin streaks of light gray clayey silt.	
44	50	6	Clay, soft, silty to sandy, light gray, light reddish brown, cream, and trace of reddish brown.	
50	60	10	Clay, fairly soft, silty to sandy, trace of gravel, light yellow-brown, cream and light gray and red mottled.	
60	75	15	Clay, fairly soft, silty to sandy, light gray, minor medium gray, traces of black silty sand(?), also yellow brown and reddish brown clays.	
75	80	5	Sand, fine to coarse, with minor gravel, also with clay streaks, light gray and light yellow brown.	
80	95	15	Sand, fine to coarse (mostly medium) with 2 to 4% gravel + 1/4", buff to light gray, thin clay streaks.	
95	101	6	Clay, moderately stiff to soft, light gray.	

3 10 00510

BEGUN 4/6/84 FINISHED 4/6/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-34

GRADE ELEV. 42.2' TOTAL DEPTH 128.5' LOCATION Stauffer Grid Coordinates S. 2480±5' E. 1890±5'

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
101	110	9	Sand, fine to coarse (mostly medium), tan to light gray.	
110	120	10	Sand, fine to medium with 5% coarse + 1/8", tan to light gray, thin clay streaks possible.	
120	127	7	Sand, fine to coarse with 3 to 5% gravel + 1/4", tan to light gray, thin clay streaks possible.	
127	128.5	1.5	Clay, stiff, light bluish gray.	
T.D.	128.5		In light bluish gray clay.	

3 10 00511

BEGUN / 34 FINISHED 4/6/84 LOGGED BY W.P.Sti DRILLED BY Holland Well Company DRILL H ; CNAM-33
GRADE
ELEV. 42.2' TOTAL DEPTH 96' LOCATION Stauffer Grid Coordinates S. 2470±5' E. 1885±5'
Drilled on Courtaulds North America Property
Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICK-NESS	LITHOLOGY	REMARKS
0	5	5	Clay, stiff, reddish brown to light yellow brown.	
5	8	3	Clay, stiff, tan to light yellow brown and light gray and red mottled.	
8	10	2	Clay, fairly stiff, silty to sandy, light yellow brown to reddish brown.	
10	17	7	Clay, slightly stiff, silty to sandy, (grades into sand), tan, light brown and light reddish brown.	
17	30	13	Sand, fine to coarse, with minor gravel, buff to light gray	"Good chatter"
30	44	14	Sand, fine to coarse, buff to light gray, with thin streaks or light gray clayey silt, also has streaks of cream clay.	
44	50	6	Clay, soft, silty to sandy, light gray, light reddish brown, cream, and trace of reddish brown.	
50	60	10	Clay, fairly soft, silty to sandy (with trace of gravel), light yellow brown, cream, light gray with red mottled.	
60	75	15	Clay, fairly soft, silty to sandy, light gray, grace of medium gray, trace of black silty sand(?), also yellow brown and reddish brown clays.	
75	80	5	Sand, fine to coarse, with minor gravel, also with clay streaks, light gray and light yellow brown.	
80	90	5	Sand, fine to coarse, with 2 to 3% gravel + 1/4", buff to light gray, contains thin clay streaks.	"Fair to good chatter"

3 10 00512

Lemoyne Plant, Axis, Alabama

BEGUN 4/6/84 FINISHED 4/6/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-33

GRADE ELEV. 42.2' TOTAL DEPTH 96' LOCATION Stauffer Grid Coordinates S. 2470±5' E. 1885±5'

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
90	94.5	4.5	Sand, fine to coarse, with 3 to 5% gravel + 1/4", buff to light gray.	"Heavy chatter"
94.5	96	1.5	Clay, fairly stiff, light gray.	
T.D.	96		In light gray clay.	

3 10 00513

LeMoyne Plant Axis, Alabama

BEGUN 84 FINISHED 4/5/84 LOGGED BY W.P.Sti DRILLED BY Holland Well Company DRILL HOLE CNAM-32

GRADE ELEV. 35.4' TOTAL DEPTH 121' LOCATION Stauffer Grid Coordinates S.2550 E.1560

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	6	6	Clay, fairly stiff, reddish brown.	
6	8	2	Sand, clayey, light reddish brown to buff.	
8	12	4	Sand, fine to medium buff to tan.	
12	19	7	Sand, fine to coarse, with minor gravel, buff to tan, yellow-brown staining on 1% of grains	"Formation taking fluid"
19	20	1	Clay, slighlty stiff, light gray and light reddish brown, trace of yellow brown.	
20	24	4	Clay, fairly soft, light gray and tan, with yellow-brown clayey silt.	
24	26	4	Sand, fine to coarse, light yellow brown.	"Drills smooth"
26	30	4	Sand, fine to coarse, light yellow brown.	"Formation taking fluid"
30	40	10	Sand, fine, buff to tan, with thin clay streaks light gray, buff, and reddich tan clay m minor yellow-brown staining.	
40	55	15	Sand, fine to coarse, with 3 to 5% gravel + 1/4", buff to tan, mixed with clay streaks, buff and light yellow-brown, (clay increases 50-55')	"Drilled smooth" "Like a soft clay or fine sand"
55	60	5	Clay, soft, silty to sandy, buff to yellowish tan, with gravelly streaks.	"A lot of foam on mud"
60	73	13	Clay, soft, buff to tan with minor light gray, thin sand streaks probable.	
73	80	10	Sand, fine to coarse, buff to tan.	
80		10	Sand, fine to coarse, buff to tan, w... very light yellowish clay(?) streaks	

3 10 00514

Geroyne Plant, Axis, Alabama

BEGUN 4/5/84 FINISHED 4/5/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-32
GRADE
ELEV. 35.4' TOTAL DEPTH 121' LOCATION Stauffer Grid Coordinates S. 2550. E. 2560.
Drilled on Courtaulds North America Property
Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
90	100	10	Sand, fine to coarse, with 3 to 5% gravel + 1/4", yellowish as above, possible clay streak @ 94', also traces of light gray and cream clay.	Fluid gone; stopped. Mixed 1 sack Revert.
100	120	20	Sand, medium to very coarse, with 5% pea gravel + 1/4", yellow-brown staining on 1 to 2% of grains.	"Heavy chatter"
120	121	1	Clay, stiff, yellowish silty clay on top of bluish clay.	
T.D.	121		In stiff bluish clay.	

3 10 00515

Lemoyne Plant, Axis, Alabama

BEGUN 4/ ____ FINISHED 4/5/84 LOGGED BY W.P.Stil DRILLED BY Holland Well Company DRILL # CNAM-31

GRADE ELEV. 35.2' TOTAL DEPTH 87.5' LOCATION Stauffer Grid Coordinates S. 2565. E. 1565.

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10'; 5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	TO	THICKNESS	LITHOLOGY	REMARKS
0	6	6	Clay, stiff, light reddish brown to yellow-brown with minor gray.	
6	8	2	Sand, clayey, light reddish brown to buff.	
8	12	4	Sand, fine to medium, buff to tan.	
12	18	6	Sand, fine to coarse, buff to tan with yellow-brown staining on about 1%	
			of grains.	
18	24	6	Clay, fairly soft, light gray with red (mottled), tan and buff.	
24	30	6	Sand, fine to coarse, tan to light yellow-brown.	
30	40	10	Sand, fine to medium, with minor coarse, buff to tan, with minor amount	
			of yellow-brown staining, thin clay streaks.	
40	50	10	Sand, fine to coarse, with 2 to 3% gravel + 1/4" thin clay streaks possible.	
50	60	10	Clay, fairly soft, tan and light gray, traces of medium gray clayey silt,	
			also some yellow brown clay, yellow brown staining ("seams") in tan	
			and gray clay.	
60	70	10	Clay, silty, fairly soft, tan and light gray with small amount staining as	"Drilled soft and smooth"
			above, thin sand streaks possible.	
70	76	6	Clay, as above, grades into sand.	
76	80	4	Sand, fine to coarse, with 2 to 3% gravel + 1/4", buff to tan	"Fair chatter"
80	87.5	7.5	Sand, fine to coarse, with minor gra contains thin clay streaks.	

3 10 0050

BEGUN 3/4/84 FINISHED 3/4/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-30

GRADE ELEV. 38.7' TOTAL DEPTH 132' LOCATION Stauffer Grid Coordinates S. 2730' E. 1155'

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	14	14	Clay, silty, traces of sand, light reddish brown to tan, and gray-red mottled clay.	
14	20	6	Clay, silty to sandy (grading into sand), softer than above, otherwise the same.	
20	30	10	Sand, fine to medium (mostly fine) tan to light reddish brown, traces of yellow brown staining.	
30	39	9	Sand, fine to coarse, buff to tan, thin clay streaks possible.	
39	50	11	Clay, slightly stiff, light gray with traces of red, also some cream to very light yellowish clay and minor tan to light brown clay (must be intermixed with sand streams), buff to white.	
50	60	10	Sand, fine to coarse, with 5 to 10% gravel + 1/8" (must be intermixed with light gray and cream clay streaks).	"Drilled like a clay with sand streaks"
60	80	29	Sand, fine to medium with minor coarse, buff to light gray (clay streaks possible).	"Light chatter"
80	90	10	Sand, fine to coarse, with 2 to 4% gravel + 1/4", tan to light gray, brown staining on 1 to 2% of grains.	
90	100	10	Sand, medium to coarse, with 3 to 5% gravel + 1/4", buff to tan, brown and yellow brown staining on 2 to 3% of grains, traces of clay,	"Chatter"

5 10 00517

LeMoyne Plant xis, Alabama

BEGUN 3, 34 FINISHED 3/4/84 LOGGED BY W.P.Stil DRILLED BY Holland Well Company DRILL HOLE CNAM-30

GRADE ELEV. 38.7' TOTAL DEPTH 132' LOCATION Stauffer Grid Coordinates S. 2730' E. 1155'

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	TO	THICKNESS	LITHOLOGY	REMARKS
100	110	10	Sand, fine to coarse with trace of gravel, tan to light brown (traces of clay)	"Heavy chatter"
110	120	10	Sand, coarse to very coarse (minor fine), buff to tan, brown staining on less than 1% of grains.	
120	130	10	Sand, coarse to very coarse (minor fine to medium but more than above), buff.	
130	132	2	Clay, stiff bluish gray, with trace of orange silty clay on top.	
T.D.	132		In stiff bluish gray clay.	

3 10 00518

BEGUN 4/3/84 FINISHED 4/3/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-29
GRADE
ELEV. 33.4' TOTAL DEPTH 85' LOCATION Stauffer Grid Coordinates S. 2740. E. 1170.
Drilled on Courtaulds North America Property
Bits: 9-3/4" Drag Bit 0 to 10';
5-3/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	8	8	Clay, silty, moderately stiff, tan to light brown, minor gray.	
8	12	4	Clay, silty to sandy, soft, light yellow brown.	
12	15	3	Sand, fine, white to light yellowish tan.	
15	20	5	Clay, sandy, fairly soft, light reddish brown to light yellow brown.	
20	30	10	Sand, fine, buff to tan, with small amount of yellow brown silt to clayey silt.	
30	38	8	Sand, fine to medium (mostly fine), tan, with traces of yellow brown staining.	"Light chatter"
38	50	12	Clay, slightly stiff, light gray with traces of red, also minor buff to tan silty to sandy clay.	
50	60	10	Sand, fine to coarse, with traces of gravel, buff to light gray.	
60	76	16	Sand, fine to coarse, buff to light gray, possible clay streaks.	
76	77	1	Clay(?), light gray.	
77	80	3	Sand, fine to medium, buff to light gray.	
80	84	4	Sand, fine to coarse, buff to light gray.	
84	85	1	Clay, light to medium gray.	
T.D.	85		In gray clay.	

3 10 00519

LeMoyne Plant Axis, Alabama

BEGUN 2 '84 FINISHED ________ LOGGED BY W.P.Sti DRILLED BY Holland Well Company DRILL ㅤ CNAM-28

GRADE

ELEV. ________ TOTAL DEPTH ______ LOCATION Stauffer Grid Coordinates S. 2609.8±2 E. 2103.±3

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';

6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	1	1	Silt, sandy, brown and yellow brown (top soil).	
1	5	4	Clay, silty, with trace of sand, stiff, light yellow brown to red brown.	
5	10	5	Clay, silty, with minor sand, softer than above, gray and red mottled.	
10	20	10	Sand, medium to coarse, buff to light yellow brown (most be a layer of high color intensity yellow-orange silty clay above 15') 3 to 5% yellow-orange staining on grains.	
20	30	10	Sand, medium to coarse, tan to light yellow brown, 2 to 3% staining.	Formation taking fluid.
30	38	8	Sand, fine to medium with minor coarse, buff.	Formation taking fluid.
38	44	6	Clay, slightly stiff, light gray and red, also yellow-brown.	
44	50	6	Sand, fine to medium, with traces of coarse, white to buff.	"Drilled soft"
50	60	10	Sand, fine to medium (mostly fine), light gray to white, thin streaks of light gray clay likely.	
60	64	4	Sand, fine to coarse, buff.	
64	69	5	Sand, medium to coarse, with 1 to 2% gravel + 1/4", buff to tan.	
69	69.5	0.5	"Sand rock" (less than 6"), medium to coarse sand and gravel, weakly cemented, yellow brown to rust.	
69.5	70	0.5	Clay, soft, cream, with yellow brown staining.	
70	71	1	Clay, slightly firm, medium gray.	

3 10 00520

BEGUN 2/6/84 FINISHED 2/6/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-27

GRADE ELEV. 44' TOTAL DEPTH 132' LOCATION Stauffer Grid Coordinates S. 2690. E. 1780.
Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	0.5	0.5	Silt, clayey, brown (topsoil).	
0.5	5	4.5	Clay, silty, fairly firm, light yellow brown with some reddish brown.	
5	10	5	Clay, silty to sandy, softer than above, light reddish brown.	
10	17	7	Clay, sandy, grades into sand, light reddish brown to light yellow brown.	
17	37	20	Sand, fine to coarse, mostly medium with traces of gravel, tan to light yellow brown.	
37	39	2	Clay, light gray.	
39	45	6	Sand, fine to medium, tan.	
45	61	16	Clay, fairly firm, light gray, cream, and light yellow brown.	
61	71	10	Clay, fiarly firm, lgiht gray, tan, minor sand streaks possible.	
71	80	9	Clay, fairly firm, traces of gravel, light gray, tan with minor light reddish brown.	
80	90	10	Sand, fine to medium, with traces of gravel, also with some clay streaks, (80% + sand - clay less than 20%).	
90	100	10	Sand, fine to coarse, with gravel, mixed with clay streaks (50% sand - clay about 50%).	
100	110	10	Sand, fine to coarse, with gravel, mixed with medium gray to light brownish gray clay streaks (90%+ sand - clay less than 10%).	"Good chatter"

3 10 00521

LeMoyne Plant Axis, Alabama

BEGUN 2 84 FINISHED 2/6/84 LOGGED BY W.P.St DRILLED BY Holland Well Company DRILL E CNAM-27

GRADE

ELEV. 55' TOTAL DEPTH 132' LOCATION Stauffer Grid Coordinates S. 2690 E. 1780

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE		THICK-NESS	LITHOLOGY	REMARKS
FROM	TO			
110	120	10	Sand, fine to coarse, with about 5% gravel + 1/4", light gray	"Good chatter"
120	131	11	Sand, fine to coarse, with minor gravel, tan to light brown, yellow brown staining on 5 to 10% of grains.	
131	132	1	Clay, thin layer of yellow-brown clayey silt on top of light bluish gray clay.	
T.D.	132		In stiff bluish clay.	

3 10 00522

BEGUN 2/8/84 FINISHED 2/8/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-26

GRADE ELEV. 36.5' TOTAL DEPTH 126' LOCATION Stauffer Grid Coordinates S. 2500. E. 1725.

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	1	1	Silt, sandy, brown, (top soil).	
1	5	4	Clay, stiff, reddish brown, minor gray.	
5	8	3	Clay, grades to sand, light reddish brown and light yellow brown, (fine to medium sand).	
8	20	12	Sand, fine to coarse, tan to light yellow brown, minor streaks of light gray and cream clay.	
20	35	15	Sand, fine to coarse, buff to tan, thin clay streaks, traces of yellow-brown staining.	
35	39	4	Clay, fairly firm, light gray with traces of red.	
39	50	11	Sand, fine, silty, with thin clay streaks, tan to light yellow brown	"Drilled soft"
50	57	7	Sand, fine, silty, with thin clay streaks.	
57	60	3	Clay, fairly firm, light gray with traces of red, minor light yellow brown.	
60	70	10	Sand, fine to medium, buff to yellow tan.	Formation taking fluid "Chatter"
70	78	8	Sand, fine to coarse (mostly medium), buff to tan	Formation taking fluid "Chatter"
78	84	6	Sand, medium to coarse, buff to light gray	Formation taking fluid Added 1 sack Revert.
84	90	6	Clay, fairly stiff, light gray, cream, minor light yellow brown, trace of red.	
90	100	10	Sand, fine to medium with minor coarse, buff to light yellow tan, staining on [illegible] of grains	Taking fluid. "Chatter"

10 00523

Lemoyne Plant Axis, Alabama

BEGUN '84 FINISHED 2/8/84 LOGGED BY W.P.Sti DRILLED BY Holland Well Company DRILL CNAM-26

GRADE

ELEV. 36.5' TOTAL DEPTH 126/ LOCATION Stauffer Grid Coordinates S. 2500. E. 1725.

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
100	105	5	Sand, as above, but with yellow-brown staining 2 to 3% of grains.	
105	107	2	Clay, fairly firm, light gray.	
107	124	17	Sand, medium to coarse, with 5% gravel + 1/4", buff to light gray, tan	
			clay streaks possible (120-124').	
124	126	2	Clay, 1/2' of yellow-brown clayey silt on top of stiff bluish gray clay.	
T.D.	126		In stiff bluish clay.	

3 10 00524

LeMoyne Plant, Axis, Alabama

BEGUN 2/2/84 FINISHED 2/2/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CHAM-25

GRADE
ELEV. 41.0' TOTAL DEPTH 131' LOCATION Stauffer Grid Coordinates S. 2795 E. 1450

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICK-NESS	LITHOLOGY	REMARKS
0	0.5	0.5	Silt, sandy, brown, (topsoil).	
0.5	1	0.5	Clay, silty, light yellow born.	
1	10	9	Clay, firm, yellow brown and reddish brown to 4', gray and red mo-tled 4' to 10'.	
10	21	11	Clay, firm to 16', moderate 16' to 21', light gray to white, traces of fine white sand.	
21	30	9	Sand, fine to coarse, with traces of gravel, buff to tan, some yellow brown staining on grains, (trace of clay).	
30	41	9	Clay, fairly soft, light gray, light yellow brown, and light red-brown, with streaks of fine to coarse sand.	
41	55	14	Clay, fairly stiff, light gray to white, with traces of red mottling, minor sand streaks, trace of gravel.	
55	64	9	Clay, soft, light gray, with minor sand and gravel streaks, gravel is buff to white with traces of yellow brown staining.	
64	81	17	Sand, fine to coarse, mostly medium, with minor gravel, light gray to buff.	Formation taking fluid. "Light chatter"
81	101	20	Sand, fine to coarse (mostly medium coarse) with 5% gravel + 1/4", buff to tan, traces of yellow brown staining on 5% of grains, clay streak likely at 99 - 101, other clay possible.	

3 10 00525

BEGUN 2 84 FINISHED 2/2/84 LOGGED BY W.P.Sti DRILLED BY Holland Well Company DRILL H CNAM-25
GRADE
ELEV. 41.0' TOTAL DEPTH 131' LOCATION Stauffer Grid Coordinates S. 2795. E. 1450.
Drilled on Courtaulds North America Property
Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
101	130	29	Sand, medium to coarse, with 5 to 10% gravel + 1/4", light gray to buff, yellow brown staining on about 5% of grains, thin (1' or less) clay streak at 114'.	
130	131	1	Clay, stiff, bluish gray (thin layer of yellow brown silt and sand rock on top of blue).	
T.D.	131		In stiff bluish clay.	

3 10 00526

BEGUN 2/7/84 FINISHED 2/7/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-24
GRADE
ELEV. 36.5' TOTAL DEPTH 127' LOCATION Stauffer Grid Coordinates S. 2610. E. 1395.
Drilled on Courtaulds North America Property
Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICK-NESS	LITHOLOGY	REMARKS
0	1	1	Silt, slightly sandy, brown, (top soil).	
1	6	5	Clay, fairly stiff, light reddish brown and light yellowish brown.	
6	10	4	Sand, fine to medium, buff to light yellow brown.	
10	20	1	Clay, silty to sandy, slightly soft, light gray and tan, trace of light	
			yellow-brown.	
20	36	16	Sand, fine to coarse, (mostly medium) buff to tan, with light yellow brown	
			staining on 2 to 5% of grains, (minor light gray clay).	
36	39	3	Clay, moderatly stiff, light gray and light brownish red.	
39	50	11	Sand, fine to medium, with trace of coarse, buff, 40 to 50%/mised with	
			50 to 60% soft clay, light gray and light brownish red.	
50	60	10	Sand, fine to medium with minor coarse, buff, with light yellow brown	
			staining on 1 to 2% of grains, contains, streaks of soft gray clay	
			(80% san 20% clay).	
60	70	10	Sand, fine to coarse, buff to tan, yellow brown staining on 1% of grains.	
70	80	10	Sand, medium to coarse, buff to light gray, traces of clay(?) may be from	
			uphole.	
80	100	20	Sand, medium to coarse, (minor fine) buff to light gray, traces of clay,	"Heavy chatter"
			yellow brown staining on 1% grai	

3 10 00527

LeMoyne Plant Axis, Alabama Page 2 of 2

BEGUN . 34 FINISHED 2/7/84 LOGGED BY W.P.St DRILLED BY Holland Well Company DRILL E CNAM-24

GRADE

ELEV. 36.5' TOTAL DEPTH 127' LOCATION Stauffer Grid Coordinates S. 2610 E. 1395

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';

6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
100	110	10	Sand, fine to coarse (mostly coarse), 2 to 5% gravel + 1/4", buff to light gray, rest as above.	"Heavy chatter"
110	125	15	Sand, fine to coarse (mostly coarse), with 5 to 10% gravel + 1/4", buff to light gray, yellow brown staining on about 3% of grains.	"Heavy chatter"
125	127	2	Clay, stiff, 1' of yellow brown clayey silt on top of light bluish gray.	
T.D.	127		In stiff bluish clay.	

3 10 00528

BEGUN 2/9/84 FINISHED 2/9/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE CNAM-23

GRADE ELEV. 33.9' TOTAL DEPTH 119' LOCATION Stauffer Grid Coordinates S.2331.2 E.2366.9

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10'; 6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	5	5	Clay, fairly stiff, reddish brown and light yellowish brown.	
5	7	2	Sand, fine to coarse (mostly coarse), tan to light yellow-brown, yellow-brown staining on 5% of grains.	
7	10	3	Clay, silty to sandy, fairly soft, light yellow brown, minor red-brown and gray with red mottled.	
10	20	10	Sand, fine to coarse, tan to light brown, minor clay streaks, soft, light red and yellow-brown.	
20	30	10	Clay, soft, tan to light reddish brown (60%) with (40) sand, fine to medium.	Drilled soft.
30	37	7	Clay, fairly firm, light gray and red mottled.	
37	40	3	Sand, clayey, soft, light yellow brown to reddish brown.	
40	50	10	Clay, silty to sandy, drilled soft.	
50	62	12	Clay (est. 80% clay/20% fine sand), silty to sandy, fairly firm, cream and light gray clay, minor red brown and yellow brown.	
62	70	8	Sand, fine to medium, with minor coarse, buff to light gray, minor light reddith brown, thin clay streaks.	
70	76	6	Sand, fine to coarse (mostly medium), buff to light gray, clays are cream and light gray, thin clay streaks.	
76	[illegible]	4	Sand, coarse to gravel - 1/4", fai[illegible] heavy yellow-brown staining on gravel.	

3 10 00529

LeMoyne Plant Axis, Alabama

BEGUN [illegible] 34 FINISHED 2/9/84 LOGGED BY W.P.Sti[illegible] DRILLED BY Holland Well Company DRILL [illegible] CNAM-23

GRADE ELEV. 33.9' TOTAL DEPTH 119' LOCATION Stauffer Grid Coordinates S. 2331.2 E. 2366.9

Drilled on Courtaulds North America Property

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	TO	THICK-NESS	LITHOLOGY	REMARKS
90	95	5	Sand, fine to coarse, with about 5% gravel + 1/4" buff to light gray.	
95	100	5	Clay, slightly firm, light gray and cream.	
100	110	10	Sand, fine to medium, with minor coarse, tan to light brown.	
110	117	7	Sand, fine to coarse, with 5% gravel + 1/4" (mostly coarse sand and gravel) light gray.	
117	119	2	Clay, fairly stiff, 1' of yellow brown to orange clayey silt on stiff bluish gray clay.	
T.D.	119		In stiff bluish clay.	

3 10 00530

[illegible] Plant, Axis, Alabama

BEGUN 1/31/84 FINISHED 1/31/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE 0-75

GRADE ELEV. 34.3 TOTAL DEPTH 125' LOCATION Stauffer Grid Coordinates S.2537.8 E. 1270.7

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	TO	THICK-NESS	LITHOLOGY	REMARKS
0	3	3	Clay, silty to sandy, reddish brown (fill).	
3	10	7	Clay, sandy to clayey fine sand, fairly soft, buff to light gray and light red-brown.	
10	17	7	Clay, sandy to silty, fot to moderately stiff, reddish brown.	
17	20	3	Sand, fine, firm, buff to tan.	
20	33	13	Sand, fine to medium, buff to white.	Formation taking fluid Added 1 sack Revert
33	40	7	Sand, medium to fine, with minor coarse sand and gravel, also minor streams of light gray, and light yellow-brown clay.	Drilled soft
40	50	10	Sand, medium to coarse, buff to tan, with streaks of light gray, dark gray, and light yellow-brown clay.	
50	60	10	Sand, fine to coarse with minor gravel, mixed with medium to dark gray clay, minor tan, and traces of yellow-brown clay.	
60	80	20	Sand, fine to coarse, with minor gravel, buff to tan.	Formation taking fluid "Light chatter"
80	90	10	Sand, same as above, with thin streaks of cream, light gray, and medium gray clay	Drilled firm.
90	100	10	Sand, fine to coarse, with 5 to 10% gravel + 1/4", clay streaks as above	Drilled firm.
100	124	24	Sand, fine to coarse, mostly coarse sand and 10% gravel + 1/4", tan to buff	"Heavy chatter"
124	125	1	Clay, stiff, light bluish gray.	

3 10 00531

LeMoyne Plant Axis, Alabama

BEGUN 2, 1 FINISHED 2/1/84 LOGGED BY W.P.St DRILLED BY Holland Well Company DRILL E 0-76

GRADE ELEV. 31.7' TOTAL DEPTH 114' LOCATION Stauffer Grid Coordinates S. 2309.5 E. 2097.

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
0	12	12	Clay, silty to sandy, firm, reddish brown to light yellowish brown.	
12	18	6	Sand, fine to coarse, with minor gravel, tan to buff.	
18	29	11	Clay, silty to sandy, firm, light gray to buff, intermixed sand streaks possible.	
29	39	10	Clay, silty to slightly sandy, firm, buff intermixed sand streaks possible.	
39	49	10	Clay, silty to sandy, white to cream and light grays with intermixed fine to coarse sand.	
49	53	4	Clay, sandy, gets more sandy with depth, buff to light gray, with fine white sand	Grades into sand.
53	59	6	Sand, fine to coarse, with minor gravel, light gray to buff.	"Light chatter"
59	71	12	Sand, fine to medium with minor coarse sand and gravel, white to buff, with light gray clay streaks. At 71' hit a hard zone, probably thin "sand rock" yellow-brown silty clay on dark gray clay.	
71	73	2	Clay, firm, dark gray.	2 to 3' of firm clay.
73	79	6	Sand, fine to coarse.	
79	86	7	Sand, fine to coarse, with gravel, also clay streaks.	"Heavy chatter" Added 2 sacks Revert
86	89	3	Sand, as above.	"Drills soft but has streaks of heavy chatter
89	99	10	Sand, fine to coarse, with 5% gr 1 1/4" to 1/2", also light gray, cream, and light reddish brown clays	

LeMoyne Plant, Axis, Alabama

BEGUN 2/1/84 FINISHED 2/1/84 LOGGED BY W.P.Stilson DRILLED BY Holland Well Company DRILL HOLE 0-76

GRADE

ELEV. 31.7' TOTAL DEPTH 114' LOCATION Stauffer Grid Coordinates S. 2309.5 E. 2097.

Bits: 9-3/4" Drag Bit 0 to 10';
6-1/4" Drag Bit 10' to T.D. Mud: Johnsons Revert

FOOTAGE FROM	FOOTAGE TO	THICKNESS	LITHOLOGY	REMARKS
99	112	13	Sand, fine to coarse (with some buff to light yellowish silty sand) mixed with clay streaks.	
112	114	2	Clay, stiff, about 1' yellow-brown to orange silty clay on top of stiff blud clay.	
T.D.	114		In stiff bluish clay.	

3 10 00533

3 10 00534

APPENDIX XXVIII

WATER-LEVEL DATA

3 10 00535

DESIGNE
TECHNICAL CENTER
WESTERN ENGINEERING

Stauffer Chemical Company
1391 S. 49th St. Richmond, CA 94804 Tel. (415) 231-1300 TELEX

October 30, 1987

Mr. Mark Taylor
Camp Dresser & McKee, Inc.
2100 Riveredge Parkway
Suite 400
Atlanta, Georgia 30328

Dear Mr. Taylor:

The scheduled program to obtain additional water level and pumping rate data from the Cold Creek-LeMoyne site, as set forth in my September 28, 1987 letter to Ms. Van Duzee (EPA, copy to Mark Taylor), was essentially terminated on the morning of October 7th and rescheduled for October 13th through 15th, 1987. Ms. Van Duzee was on site to oversee data collection on October 14th and 15th.

Groundwater level and pumping rate data obtained between October 6 and 16, 1987 are presented according to the CDM Reference number and in the same format used in my July 31, 1987 letter, in which the data from last November's program were presented. The groundwater level data are presented in Attachment 1, information pertaining to the amount of water pumped from Stauffer's water supply wells is presented in Attachment 2, and information pertaining to the amount of water pumped from Stauffer's Groundwater Intercept System wells is presented in Attachment 3.

In an attempt to minimize the problems encountered during the data collection period in November 1986, personnel at both plants were contacted during mid and late September and made aware of the program scheduled for the week of October 5th, 1987. The Cold Creek plant indicated that they would supply their water needs from well CC-12 (as they usually do) and would not schedule any operations requiring above "normal" amounts of water. Additionally, it was agreed that the LeMoyne plant would 1) shut down wells LM-5 and LM-10 on or about September 28th, and that these wells would remain off until the program was completed; 2) not schedule any maintenance work requiring the shutdown of any operating well; and 3) not schedule operations requiring above "normal" amounts of water.

If the program had been completed by October 9, 1987, as originally scheduled, we would have been successful in obtaining a set of water level data from just about as stable of a pumping rate and pattern as is likely to occur at the Cold Creek-LeMoyne site. However, the water supply header from well LM-6 broke between 1500 and 1600 hours on Friday, October 9th. This resulted in the plant shutting down LM-6 so the water line could be repaired and turning on wells LM-5 and LM-10 to provide sufficient water to keep the various plants operating.

3 10 00536

With well LM-6 shut down for almost 70 hours, the approximately 18-foot deep cone of depression would have almost totally recovered; and, water levels in the vicinity of wells LM-5 and LM-10 would be declining rapidly from Friday afternoon until Monday. Then, by Monday afternoon, the 12th, the wells were returned to their pre-existing pumping pattern and water level trends in the respective areas underwent rapid reversals. As a result of the above, groundwater levels for wells completed in the lower confined aquifer in the northwestern part of the property (O-8, O-27, CC-11, LM-5, & LM-10) were lower by one to several feet on October 13th than they were on October 7th.

The intercept well system at LeMoyne has been operating at a fairly steady rate over the past several weeks. The center well (IW-2) is now pumping about 325 gpm, which is only 72 percent of the designated operating rate. This decrease in pumping rate results in the elevation of the water surface in the center well being a few tenths of a foot higher than the elevation of the water surface at either of the two end wells; and does not appear to significantly reduce the effectiveness of the intercept system.

The average daily pumping rate from well CC-12 at the Cold Creek Plant has ranged from a high of 235 gpm on September 28, 1987 to a low of 108 gpm on October 8, 1987, and the overall average daily pumping rate was 168 gpm for the 23-day period (9/28/87-10/20/87).

Mr. John Stewart, the Environmental Services Manager at Courtauld's plant informed me that their water use has remained at a fairly steady rate of about 7.5 million gallons per day for the period from September 28th to October 19th, 1987. They are using ten wells to obtain this volume of water. Nine wells are process water supply wells producing about 550 gpm each, and the tenth well is their drinking water supply well (No. 16) which may be producing 200 to 250 gpm. From October 9-12, they were using wells nos. 3, 4, 5, 7, 9, 10, 11, 13, 16, and 17; and from October 12-15 they were using well nos. 3, 4, 5, 7, 9, 11, 13, 14, 16, and 17. They use their well no.14 as a "swing well", which they put on line when one of the regularly used wells are taken off line for treatment.

We feel certain that the groundwater elevation data resulting from the October 1987 field effort (see Attachments) provide a more adequate data base than do those data obtained in November 1986; and furthermore, that these new data will be of significant benefit to anyone attempting to develop and calibrate a groundwater flow model for the area of the Stauffer plant sites.

3 10 00537

If you have any questions regarding the attached data or comments, please do not hesitate to contact me.

Very truly yours,

William P. Stilson

William P. Stilson
Senior Geologist

WPS:lb

cc: Ms. Ellen Van Duzee
Site Project Manager
Environmental Protection Agency
345 Courtland Street
Atlanta, GA 30365

Mr. Joe Downey
Alabama Dept. of Environmental Management
1751 Federal Drive
Montgomery, AL 36130

Mr. Kurt Batsel
Camp Dresser & McKee, Inc.
2100 Riveredge Drive
Suite 400
Atlanta, GA 30328

L. Erickson
D. Flack
R. Halstead
T. Sayers
D. Smith

ATTACHMENT I

GROUNDWATER LEVEL MEASUREMENTS FOR WELLS IN SECTION V
Based on Depth to Water Measurements Made on October 6-16, 1987

3 10 00358

CDM Reference No. Section V	Stauffer Well Description	Date	Time	Elevation Top of Casing or Measuring Point	Depth to Water	Elevation of Groundwater	Comment
None	LM-2 Process Water Supply	10-06-87	1610	46.70	77.53*	-30.83	pumping
		10-07-87	1145		79.84*	-33.14	pumping
		10-08-87	1227		---	---	pumping
		10-13-87	1040		76.14*	-29.44	pumping
		10-14-87	1359		79.14*	-32.44	pumping
		10-15-87	1645		74.98*	-28.28	pumping
		10-16-87	1345		---	---	pumping
None	LM-5 Process Water Supply	10-06-87	1540	44.09	---	---	well off
		10-07-87	1155		50.23*	- 6.14	well off
		10-08-87	1220		---	---	well off
		10-09-87	1600		---	---	well turned on
		10-12-87	0930		---	---	well turned off
		10-13-87	1148		51.62*	- 7.53	well off
		10-14-87	1051		51.39*	- 7.30	well off
		10-15-87	1735		---	---	well off
		10-16-87	1345		---	---	well off
65	LM-6 Process Water Supply	10-06-87	1550	44.18	67.68*	-23.50	pumping
		10-07-87	1130		68.83*	-24.65	pumping
		10-08-87	1234		---	---	pumping
		10-09-87	1600		---	---	well turned off
		10-12-87	1200		---	---	well turned on
		10-13-87	0953		67.68*	-23.50	pumping
		10-14-87	1104		71.87*	-27.69	pumping
		10-15-87	1658		68.60*	-24.42	pumping
		10-16-87	1325		---	---	pumping
66	LM-7 Drinking Water and Process Water Supply	10-06-87	1532	40.98	---	---	pumping
		10-07-87	1211		58.20*	-17.22	pumping
		10-08-87	1218		---	---	pumping
		10-13-87	1109		60.51*	-19.53	pumping
		10-14-87	1042		60.51*	-19.53	pumping
		10-15-87	1301				[illegible]

ATTACHMENT 1

GROUNDWATER LEVEL MEASUREMENTS FOR WELLS IN SECTION V
Based on Depth to Water Measurements Made on October 6-16, 1987

3 10 00539

CDM Reference No. Section V	Stauffer Well Description	Date	Time	Elevation Top of Casing or Measuring Point	Depth to Water	Elevation of Groundwater	Comment
67	LM-10 Drinking Water and Process Water Supply	10-07-87	1222	43.91	43.98	- 0.07	well off
		10-08-87	1203		---	---	well off
		10-09-87	1620		---	---	well turned on
		10-12-87	1615		---	---	well turned off
		10-13-87	1120		50.00	- 6.09	well off
		10-14-87	1027		47.94	- 4.03	well off
		10-16-87	1301		---	---	well off
68	CC-11 Standby Only Drinking Water and Process Water Supply	10-07-87	1631	39.61	45.00	- 5.39	well off
		10-13-87	1546		47.00	- 7.39	well off
69	CC-12 Drinking Water and Process Water Supply	10-07-87	1622	33.97	---	---	pumping
		10-13-87	1615		---	---	pumping
70	IW-1 Intercept Well	10-06-87	1352	36.42	55.05	-18.36	pumping
		10-07-87	1027		55.16	-18.74	pumping
		10-08-87	1246		55.10	-18.68	pumping
		10-13-87	1003		55.38	-18.96	pumping
		10-14-87	1121		55.41	-18.99	pumping
		10-15-87	0858		55.48	-19.06	pumping
		10-16-87	1330		---	---	pumping
71	IW-2 Intercept Well	10-06-87	1359	37.06	54.94	-17.88	pumping
		10-07-87	1034		55.03	-17.97	pumping
		10-08-87	1255		55.13	-18.07	pumping
		10-13-87	1010		55.20	-18.14	pumping
		10-14-87	1130		55.27	-18.21	pumping
		10-15-87	0926		55.30	-18.24	pumping
		10-16-87	1332		---	---	pumping

ATTACHMENT I

GROUNDWATER LEVEL MEASUREMENTS FOR WELLS IN SECTION V
Based on Depth to Water Measurements Made on October 6-16, 1987

3 10 005 40

CDM Reference No. Section V	Stauffer Well Description	Date	Time	Elevation Top of Casing or Measuring Point	Depth to Water	Elevation of Groundwater	Comment
72	IW-3 Intercept Well	10-06-87	1406	36.01	54.34	-18.33	pumping
		10-07-87	1040		54.47	-18.46	pumping
		10-08-87	1303		54.59	-18.58	pumping
		10-13-87	1015		54.58	-18.57	pumping
		10-14-87	1135		54.65	-18.64	pumping
		10-15-87	0938		54.70	-18.69	pumping
		10-16-87	1334		---	---	pumping

Based on Depth to Water Measurements Made on October 13-15, 1987

CDM Reference No. Section V	Stauffer Well Description	Date	Time	Elevation Top of Casing or Measuring Point	Depth to Water	Elevation of Groundwater	Comment
73	#0-17	10-13-87	1611	38.95	27.38	+11.57	
74	0-5	10-13-87	1551	34.92	23.17	+11.75	
75	0-8	10-13-87	1520	34.73	42.39	- 7.67	completed in confined aquifer
76	0-16 (CCM-9)	10-13-87	1536	31.40	31.77	- 0.37	
77	CCM-6	10-13-87	1528	28.04	30.07	- 2.03	
78	0-14 (CCM-8)	10-13-87	1328	31.80	33.90	- 2.10	
79	0-26 (CCM-11)	10-13-87	1556	46.85	36.91	+ 9.94	
80	0-27	10-13-87	1601	45.82	52.68	- 6.86	completed in confined aquifer
81	0-25	10-13-87	1126	47.24	55.21	- 7.97	
82	CCM-7	10-13-87	1515	33.23	37.27	- 4.04	
83	0-21 (CCM-10)	10-13-87	1334	30.26	35.98	- 5.72	
84	0-18	10-13-87	1134	45.27	53.12	- 7.85	
85	0-80 (HM-1)	10-13-87	1136	44.08	52.03	- 7.95	
86	IM-3	10-13-87	1447	45.59	52.88	- 7.29	
87	CCM-3	10-13-87	1500	32.79	39.50	- 6.71	
88	0-6	10-14-87	1411	42.96	54.96	-11.85	
89	0-78	10-14-87	----	---	---		top of casing on well broken off - substitute 0-77 for 0-78
None	0-77	10-14-87	1406	45.17	52.25	-14.08	
90	0-35	10-14-87	1731	39.35	52.45	-13.10	
91	0-33	10-14-87	1739	37.35	51.14	-13.79	
92	0-31	10-15-87	0953	38.42	53.46	-15.04	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

ATTACHMENT I

GROUNDWATER LEVEL MEASUREMENTS FOR WELLS IN SECTION V
Based on Depth to Water Measurements Made on October 13-15, 1987

CDM Reference No. Section V	Stauffer Well Description	Date	Time	Elevation Top of Casing or Measuring Point	Depth to Water	Elevation of Groundwater	Comment
94	#0-46	10-14-87	1649	39.07	50.30	-11.23	
95	0-38	10-14-87	1719	32.53	46.54	-14.01	
96	0-42	10-14-87	1642	40.56	51.74	-11.18	
97	0-48	10-14-87	1535	32.45	45.48	-13.03	
98	0-74	10-14-87	1547	34.19	45.84	-11.65	
99	0-66	10-14-87	1528	36.83	49.92	-13.09	
100	0-62	10-14-87	1451	35.04	46.47	-11.43	
101	0-56	10-14-87	1442	30.44*	41.09	-10.65	
102	0-59	10-14-87	1430	38.13	47.72	- 9.59	
103	0-53	10-14-87	1419	35.41*	44.21	- 8.80	
104	0-70	10-14-87	1557	30.71	39.53	- 8.82	
105	0-68	10-14-87	1623	26.76	34.79	- 8.03	
106	0-50 (CCM-12)	10-13-87	1343	41.34	44.45	- 3.11	
107	0-51	10-13-87	1356	47.27	50.70	- 3.43	
108	0-52	10-13-87	1351	47.51	52.62	- 5.11	
109	0-23	10-14-87	1232	13.48	15.22	- 1.47	
110	0-24	10-14-87	1200	13.90	14.12	- 0.22	
111	NM-1	10-14-87	1225	46.91	52.64	- 5.73	
None	0-22	10-14-87	1215	34.83	34.66	- 3.40	
112	NM-2	10-14-87	1210	24.91	27.20	- 2.29	
113	CNAM-30	10-15-87	1038	41.26	55.20	-13.94	
114	CNAM-25	10-15-87	1054	43.18	57.38	-14.20	
115	CNAM-32	10-15-87	1108	37.99	52.94	-14.95	
116	CNAM-22	10-15-87	1149	41.77	55.84	-14.07	
117	CNAM-34	10-15-87	1134	45.00	59.70	-14.70	
118	CNAM-23	10-15-87	1221	36.34	49.69	-13.35	
	(Courtaulds Well MW-1)	10-15-87	1202	37.25	50.40	-13.15	
119	CNAM-1						
	(Courtaulds Well MW-2)	10-15-87	1212	45.45	58.46	-13.01	
120	CNAM-2						
	(Courtaulds Well MW-3)	10-15-87	---	48.81	---	---	did not make measurement
121	CNAM-3						

3 10 00541

3 10 00542

ATTACHMENT 2

GROUNDWATER PUMPING RATES AT COLD CREEK - LEMOYNE, ALABAMA
FOR WATER SUPPLY WELLS AND PROCESS WATER WELLS IN SECTION V (CDM REFERENCE)
Based on Information Obtained During Week of October 5-9 and 12-16, 1987

CDM Reference No. Section V	Stauffer Well Description	Date	Time	Discharge Pressure (psig)	Estimated Flow Rate (gpm)	Comments
(None)	LM-2 (LeMoyne Plant process water well)	10-06-87	1610	61.0(T)	580	(T) test gauge
				59.5	600	
		10-07-87	1145	56.5(T)	640	
				56.5	640	
		10-08-87	1227	52.5	680	
		10-13-87	1040	62.5(T)	550	
				61.0	580	
		10-14-87	1359	58.0	620	
		10-15-87	1645	62.5	550	
		10-16-87	1345	55.0	660	
(None)	LM-5 (LeMoyne Plant process water well)	10-06-87	1540	0	0	well off
		10-07-87	1155	0	0	well off
		10-08-87	1220	0	0	well off
		10-09-87	1600	---	---	well turned on
		10-09-87	1720	---	---	well turned off
		10-10-87	0720	---	---	well turned on
		10-10-87	1130	---	---	well turned off
		10-10-87	1415	---	---	well turned on
		10-12-87	0930	---	---	well turned off
		10-13-87	0944	0	0	well off
		10-13-87	1148	0	0	well off
		10-14-87	1051	0	0	well off
		10-15-87	1735	0	0	well off
		10-16-87	1316	0	0	well off
65	LM-6 (LeMoyne Plant process water well)	10-06-87	1550	67.0(T)	430	
		10-07-87	1130	63.5(T)	480	
		10-08-87	1234	63.0	470	
		10-13-87	0953	68.0(T)	410	
		10-14-87	1104	59.5(T)	520	
				61.2(?)	490	(?) gauge
		10-15-87	[illegible]8	65.0(T)	460	[illegible]
				60.0(?)	520	
		[illegible]				

ATTACHMENT 2

GROUNDWATER PUMPING RATES AT COLD CREEK - LEMOYNE, ALABAMA
FOR WATER SUPPLY WELLS AND PROCESS WATER WELLS IN SECTION V (CDM REFERENCE)
Based on Information Obtained During Week of October 5-9 and 12-16, 1987

3 10 0043

CDM Reference No. Section V	Stauffer Well Description	Date	Time	Discharge Pressure (psig)	Estimated Flow Rate (gpm)	Comments
66	LM-7 (LeMoyne Plant Process Water Well	10-06-87	1532	broken gauge	520 (440-560)	5 min. average flow
		10-07-87	1211	65-74(T)	370	10 min. average flow
		10-08-87	1218	broken gauge	400	10 min. average flow
		10-13-87	1109	74.0(N) 72.0(T)	380	(N)installed new gau[illegible] 10 min. average flow
		10-14-87	1042	72.0(N)	340	10 min. average flow
		10-16-87	1257	66-75(N)	360 (180-440)	5 min. average flow
67	LM-10 (LeMoyne Drinking and Process Water Well)	10-07-87	1222	0	0	well off
		10-08-87	1203	0	0	well off
		10-09-87	1620	---	---	well turned on
		10-12-87	1615	0	0	well turned off
		10-13-87	1120	0	0	well off
		10-14-87	1027	0	0	well off
		10-16-87	1301	0	0	well off
68	CC-11 (Cold Creek Drinking and Process Water Well)	10-07-87	1631	0	0	well off
		10-13-87	1546	0	0	well off
69	CC-12 (Cold Creek Drinking and Process Water Well)	10-07-87	1622	76.0	130	10 min. average flow
		10-13-87	1615	61.0	180	10 min. average flow

3 10 0054 4

ATTACHMENT 3

GROUNDWATER PUMPING RATES AT COLD CREEK -LEMOYNE ALABAMA
FOR GROUNDWATER INTERCEPT SYSTEM WELLS (AT LEMOYNE) IN SECTION V (CDM REFERENCE)
Based on Information Obtained During Week of October 5-9 and 12-16, 1987

CDM Reference No. Section V	Stauffer Well Description	Date	Time	Discharge Pressure (psig)	Estimated Flow Rate (gpm)	Comments
70	IW-1 Intercept Well No. 1 (east)	10-06-87	1352	96	330	
		10-07-87	1027	94	375	by difference
		10-08-87	1246	96	325(?)	by meter(?) meter not working properl-
					375	by difference
		10-13-87	1003	96	375	by difference
		10-14-87	1121	96	355	
		10-15-87	0858	96	330	by meter
		10-16-87	1330	96	360	by meter
71	IW-2 Intercept Well No. 2 (center)	10-06-87	1359	58	310	
		10-07-87	1034	58	325	
		10-08-87	1255	58	325	
		10-13-87	1010	58	325	
		10-14-87	1130	58	325	
		10-15-87	0926	57.5	320	
		10-16-87	1332	56	320	
72	IW-3 Intercept Well No. 3 (west)	10-06-87	1406	59	500	
		10-07-87	1040	59	500	
		10-08-87	1303	60	510	
		10-13-87	1015	59	500	
		10-14-87	1135	59	520	
		10-15-87	0938	58	520	
		10-16-87	1334	58.5	520	
None	Total Flow IW-1, 2, & 3 at Totalizing Flow Meter	10-06-87	1421		1180	4 min. average flow
		10-07-87	1048		1200	3 min. average flow
		10-08-87	1309		1200	4 min. average flow
		10-13-87	1024		1200	5 min. average flow
		10-14-87	[illegible]150		1200	10 min. [illegible]rage flow
		10-15-87	[illegible]15		1180	10 min [illegible]rage flow
		[illegible]	[illegible]		[illegible]	[illegible]

3 10 00545

APPENDIX XXIX

ECKHARDT SURVEY INFORMATION

REGARDING THE LEMOYNE LANDFILL

3 10 00546

INSTRUCTIONS

WASTE DISPOSAL SITE SURVEY

PURPOSE

WHO IS INCLUDED IN THE SURVEY

TIME PERIOD TO BE COVERED

FORMS: A: GENERAL FACILITY INFORMATION
B: DISPOSAL SITE INFORMATION
C: HAULER INFORMATION
D: SUPPLEMENTAL HAULER INFORMATION

COMPLETING THE FORM

WHO TO CALL WITH QUESTIONS

[redacted]

Conducted by:

Subcommittee on Oversight and Investigations

Committee on Interstate and Foreign Commerce

U. S. House of Representatives

Hon. Bob Eckhardt, Chairman

April 1979

3 10 00547

PURPOSE

This Waste Disposal Site Survey is being conducted by the Subcommittee on Oversight and Investigations of the Committee on Interstate and Foreign Commerce, U. S. House of Representatives. The purpose of the survey is to begin to identify the location of sites in the United States used for the disposal of chemical plant process waste materials since 1950. The fifty largest chemical companies and their subsidiaries or affiliates are included in this first national survey. Information gathered will assist the Congress in addressing the problems posed by active as well as inactive or abandoned waste disposal sites. The information will also be useful to the U. S. Environmental Protection Agency in effectively implementing the Resource Conservation and Recovery Act of 1976.

WHO IS INCLUDED IN THE SURVEY

The survey is based on the experiences of the 50 largest chemical companies in the United States. A complete set of instruments is to be filled out for every facility or plant in the United States owned, operated or leased by one of these companies or any of their subsidiary or affiliated companies.

It is recommended that the corporate headquarters, to whom the survey instruments are sent, send a complete set of instruments and the instruction manual to the plant manager or supervisor of each of the company's plants or facilities. The plant manager or supervisor should then complete the forms using whatever records or employee knowledge he or she may have at his or her disposal. It is further requested that completed forms from each facility be returned to the corporate headquarters for final collation before returning them to the Subcommittee.

TIME PERIOD TO BE COVERED

It is the Subcommittee's intention to collect information on waste disposal sites used since 1950 (or since the time a particular facility began operation if after 1950). Some facilities may not have formal records on waste disposal dating back to 1950. The Subcommittee requests that every effort is made to reconstruct waste disposal practices for which written records do not exist. Most important is the identification (by name and location) of all sites used for the disposal of process wastes from a facility since 1950. It is very likely that employees with some tenure at a facility will know where wastes were disposed of; thus the knowledge employees may have of waste disposal practices by the facility should be explored along with record searches.

FORMS

The instrument package consists of 4 separate forms as described below:

FORM A: GENERAL FACILITY INFORMATION: This form elicits information on the total amount of process waste generated by a facility in 1978 and the methods used other than sale for use for the disposal of these wastes. This information will provide a general picture of the facility's current operations. The form also requests information on the number of sites used since 1950 for the disposal of process wastes and the hauling of process wastes from the facility. The answers to these questions will indicate whether or not (and in what numbers) Forms B, C and D need to be completed.

FORM B: DISPOSAL SITE INFORMATION: This form is to be completed for every disposal site used by the facility since 1950 for the disposal of the facility's process wastes. The property on which the facility is located may also have been used for waste disposal; if so, one Form

"B" should be used for this "on site" disposal. The form elicits information on the name, location and ownership of the site, the dates the site was used by the facility, the amount and content of the process waste disposed at the site from the facility, the current status of the site as well as the types of disposal methods used at the site. In all instances a facility should seek the answers to each of the questions. (NOTE: Form "B" consists of 2 pages.)

FORM C: HAULER INFORMATION: This form asks a facility to list the names and addresses of all firms or independent contractors (including the company and its affiliates and subsidiaries) who since 1950 removed process waste materials from the facility. Information on the years used is also requested.

FORM D: SUPPLEMENTAL HAULER INFORMATION: Some process wastes may have been hauled from a facility and taken to a location unknown to the facility. For every firm or contractor who has taken waste in this manner from a facility, Form D elicits information on the content and amount of wastes hauled and the dates the hauler was used.

COMPLETING THE FORMS

The information requested on the forms is largely numerical in nature. Block spaces have been provided for this information. Respondents are requested to write (or type) responses clearly within these spaces. In any instance in which the response has fewer digits than the number of spaces provided, the response should be right justified. For example, if a facility generated 21,292 tons of process waste during 1978, the response on Form A, Question 3 would be recorded as follows:

hundred tons . . . . [| | | | |2|1|3] (25-32)

In requesting information on amounts of process waste generated, disposed at a given site or hauled by a given firm/contractor, three different categories (gallons, tons and cubic yards) have been provided. One or all of these categories may be used, depending upon which is most convenient for a facility. In no instance, however, should the amount of waste be double counted (i.e. a given amount should not be recorded as both gallons and tons).

All non-numerical responses (eg. names and addresses) should be written legibly or typed in the spaces provided. If there is a need to clarify responses to any questions, clarification should be provided on the back of the form or on an appended page.

WHO TO CALL WITH QUESTIONS

The Subcommittee will hold a private briefing for all companies asked to participate in this survey on Friday, April 27, 1979 at 3:00 p.m. in 2123 Rayburn House Office Building in order to answer any questions or concerns. Companies should hold all initial questions for this private briefing. Following this date, all questions should be directed to Anne Cohn, Survey Coordinator at (202) 225-4231 or Mark Raabe, Staff Director, at (202) 225-4441.

3 10 00549

FORM A - GENERAL FACILITY INFORMATION

Company Name: STAUFFER CHEMICAL COMPANY

Facility Name: LEMOYNE PLANT (ICD)

Address: PO BOX 100
No. Street

AXIS ALABAMA 36505
City State Zip Code

Name of Person Completing Form: P.S. PERRY

Position: PLANT MANAGER

Phone Number: (205) 675-1310

1. Year Facility Opened .... 19 |5|2| (10-11)

2. Primary SIC Code .... |2|8|1|2| (12-15)

3. Estimate the total amounts of process wastes (excluding wastes sold for use) generated by this facility during 1978:

   thousand gallons .... | | | | | | | | | | (16-24)

   hundred tons .... | | | | | |4|2|7| (25-32)

   thousand cubic yards .... | | | | | | | | | | (33-41)

4. Estimate (in whole percents) how these process wastes generated in 1978 were disposed of:

   in landfill .... | |1|0| (42-44)

   in pit/pond/lagoon .... | |9|0| (45-47)

   in deep well .... | | |0| (48-50)

   incinerated .... | | |0| (51-53)

   reprocessed/recycled .... | | |0| (54-56)

   evaporated .... | | |0| (57-59)

   unknown .... | | |0| (60-62)

   other (Specify ____________) .... | | |0| (63-65)

5. What is the total number of known sites (including disposal on the property where this facility is located as one site) that have been used for the disposal of process wastes from this facility since 1950? .... | | |4| (66-68)

   COMPLETE ONE FORM "B" FOR EACH OF THE SITES

6. Have any of the process wastes generated at this facility been hauled (removed) from this facility for disposal? (Yes=1; no=2) .... |1| (69)

   IF YES, COMPLETE FORM "C"

7. Do you know the disposal site locations of all of the process waste hauled from your facility since 1950? (Yes=1; no=2) .... |1| (70)

   IF NO, COMPLETE ONE FORM "D" FOR EACH FIRM OR CONTRACTOR WHO TOOK WASTE TO AN UNKNOWN LOCATION

8. Specify the earliest year represented by information from company or facility records supplied on this and other forms .... 19|7|3| (71-72)

9. Specify the earliest year represented by information from employee knowledge supplied on this and other forms .... 19|5|2| (73-74)

3 10 00550

Company Name: Stauffer Chemical Co

Facility Name: Le Moyne Plant (ICD)

Site Name: Abandoned Dump Site

3

Components (or characteristics) of process waste from this facility disposed at site: (1=present in waste; 2=not present in waste; 9=don't know)

FILL IN EVERY BLOCK SPACE

Acid solutions, with pH<3	2	(10)
pickling liquor		(11)
metal plating waste		(12)
circuit etchings		(13)
inorganic acid manufacture	2	(14)
organic acid manufacture		(15)
Base solutions, with pH>10	2	(16)
caustic soda manufacture	2	(17)
nylon and similar polymer generation		(18)
scrubber residual		(19)
Heavy metals & trace metals (bonded organically & inorganically)	2	(20)
arsenic, selenium, antimony		(21)
mercury	2	(22)
iron, manganese, magnesium	2	(23)
zinc, cadmium, copper, chromium (trivalent)	9	(24)
chromium (hexavalent)	9	(25)
lead	9	(26)
Radioactive residues, >3 pico curies/liter	2	(27)
uranium residuals & residuals for UF_6 recycling		(28)
lathanide series elements and rare earth salts		(29)
phosphate slag		(30)
thorium		(31)
radium		(32)
other alpha, beta & gamma emitters		(33)
Organics	2	(34)
pesticides & intermediates		(35)
herbicides & intermediates		(36)
fungicides & intermediates		(37)
rodenticides & intermediates		(38)
halogenated aliphatics		(39)
halogenated aromatics		(40)
acrylates & latex emulsions		(41)
PCB/PBB's		(42)
amides, amines, imides		(43)
plastizers		(44)
resins		(45)
elastomers		(46)
solvents polar (except water)		(47)
carbontetrachloride	2	(48)
trichloroethylene		(49)
other solvents nonpolar		(50)
solvents halogenated aliphatic		(51)
solvents halogenated aromatic		(52)
oils and oil sludges	2	(53)
esters and ethers		(54)
alcohols		(55)
ketones & aldehydes		(56)
dioxins		(57)
Inorganics	2	(58)
salts	2	(59)
mercaptans		(60)
Misc.	2	(61)
pharmaceutical wastes		(62)
paints & pigments	2	(63)
catalysts (eg. vanadium, platinum, palladium)		(64)
asbestos		(65)
shock sensitive wastes (eg. nitrated toluenes)		(66)
air water reactive wastes (eg. P_4, aluminum chloride)		(67)
wastes with flash point below 100° F.		(68)

2 (80)